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FIRST ANNUAL REPORT

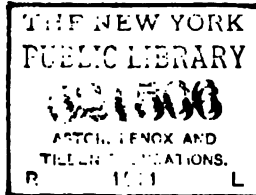
OF THE

★ CHARLES RIVER BASIN  
COMMISSION.

OCTOBER 1, 1903.



BOSTON :  
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,  
18 POST OFFICE SQUARE.  
1904.



APPROVED BY  
THE STATE BOARD OF PUBLICATION.

FROM WAR  
31004  
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# Commonwealth of Massachusetts.

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## REPORT OF THE COMMISSION.

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*To His Excellency the Governor and the Honorable Council of the Commonwealth of Massachusetts.*

The commission appointed under chapter 465 of the Acts of the year 1903, and termed the Charles River Basin Commission, has the honor to make the following report of its proceedings and expenditures, in accordance with section 2 of the act establishing the commission. According to chapter 9, section 5, of the Revised Laws of Massachusetts for 1902, such reports shall include the year ending on the thirtieth day of September; and, as the commission had been at this date but two months in existence, it necessarily follows that only a very brief account of its work can be given.

The act establishing the commission was approved on June 24, 1903, and the present members of the commission were confirmed at a meeting of the Governor and Council on July 22, 1903. The members of the commission qualified on July 29, and there was held on that day, at the office of the president of the Massachusetts Institute of Technology, the first meeting of the Charles River Basin Commission, there being present the chairman, Henry S. Pritchett, and the commissioners, Henry D. Yerxa and Joshua B. Holden.

The first work of the commission was to familiarize itself with the duties committed to it under the act by which it was created. As the principal work of the commission consists in the carrying out of certain engineering projects, it naturally followed that the selection and organization of an engineering staff was the earliest, as well as the most important, task to which the commission could address itself;

and the two months of its existence covered by the year ending Sept. 30, 1903, were almost entirely given to this problem, and to that of finding quarters suitable for the work of the commission and its engineers.

After the most careful inquiry, and consultation with leading engineers of the country, an engineering staff was selected, as follows : —

Mr. HIRAM A. MILLER,	.	.	<i>Chief Engineer.</i>
Mr. FREDERIC P. STEARNS,	.	.	<i>Consulting Engineer.</i>
Mr. JOHN L. HOWARD,	.	.	<i>Division Engineer, in charge of surveys, construction and field work.</i>
Mr. FRANK E. WINSOR,	.	.	<i>Division Engineer, in charge of designing, drafting and office work.</i>
Mr. JOHN N. FERGUSON,	.	.	<i>Assistant Engineer.</i>

In addition, Miss Jennie L. Rawson was engaged as stenographer and clerk.

The appointments of the chief engineer and consulting engineer have already been reported to the Governor and Council, and received their approval.

After a very careful study of the needs of the commission, and in view of its engineering problems, a lease was taken, for a period of one year, of seven rooms in the Standish building, 367 Boylston Street, at a rental of \$2,100. These quarters have proved admirably adapted for the needs of the commission, as the rooms are unusually well lighted and afford admirable places for drafting tables. The selection of these quarters has also been approved by the Governor and Council.

In addition to the organization of an engineering staff and the securing of quarters suitable for work, the commission busied itself during the months of August and September in the effort to become acquainted with the present situation of the problems committed to it, and with consulting other similar commissions, such as the Metropolitan Water and Sewerage Board, the office of the sewer division of the city of Boston and the Board of Park Commissioners of Boston, the work of which has most to do with its own.

By the end of September the engineering staff of the commission had been selected and organized, the quarters for the use of the commission and of its engineers were in order,

and the work had been begun. Arrangements were made for beginning at once the field work of borings along the proposed site of the dam, and the preparation of designs was begun in the office for the preliminary studies of the dam itself and of the lateral conduits.

The organization of an engineering staff, the preparation of quarters and the preliminary examination of the problems themselves committed to the commission have constituted practically the work which the commission has been able to accomplish in the two months of its existence which are included in this report.

In carrying forward this organization the commission has endeavored to carry out the provisions of the act in the most thorough way, and with the strictest view to economy. No expense has been incurred, either in the engineering department or in the executive work, which could be avoided, and the commission has increased its organization and its force only so rapidly as the requirements of the work demanded.

A statement of the expenditures incurred by the commission and of its assets and liabilities to September 30 is as follows: —

## EXPENDITURES.

The total amount of expenditures from July 29, 1903, the time of the organization of the commission, until Sept. 30, 1903, was \$433.01.

The general character of these expenditures was as follows: —

*Administration.*

Clerks and stenographers, . . . . .	\$15 00	
Stationery and printing, . . . . .	5 10	
Postage, express and telegrams, . . . . .	1 00	
Furniture and fixtures, . . . . .	12 20	
	<hr/>	\$33 30

*Engineering.*

Engineering assistants, . . . . .	\$60 00	
Travelling, . . . . .	10 00	
Wagon hire, . . . . .	4 50	
Stationery and printing, . . . . .	7 63	
Postage, express and telegrams, . . . . .	4 20	
Instruments and tools, . . . . .	87 75	
	<hr/>	
<i>Amounts carried forward,</i> . . . . .	\$174 08	\$33 30



6 CHARLES RIVER BASIN COMMISSION. [Jan.

<i>Amounts brought forward,</i>		\$174 08	\$33 30
Books, maps and photographic supplies,		6 00	
Furniture and fixtures,		219 48	
Unclassified supplies,		15	
			<u>399 71</u>
Total,			\$433 01

The foregoing expenditures have been distributed among the various objects or works, as follows :—

Administration, applicable to all parts of the work,	\$33 30
Dam,	119 00
Lock,	72 98
Drawbridge,	13 28
Dredging basin,	7 00
Broad canal,	32 00
Lechmere canal,	16 10
Boston marginal conduit,	106 00
Cambridge marginal conduit,	33 35
Total,	<u>\$433 01</u>

ASSETS.

The only purchases which have thus far been made are those incidental to the organizing of the general office. The only assets, therefore, are office furniture and fittings, and engineering and drafting instruments and tools.

LIABILITIES.

Current bills unpaid,	\$1,050 00
Due on pay rolls,	1,810 00
Total,	<u>\$2,860 00</u>

There are no claims pending against the commission.

Attached hereto is a report of the chief engineer, also a copy of the act under which the commission was organized and is proceeding.

Respectfully submitted,

HENRY S. PRITCHETT,  
HENRY D. YERXA,  
JOSHUA B. HOLDEN,

*Charles River Basin Commission.*

Boston, Jan. 7, 1904.

## REPORT OF THE CHIEF ENGINEER.

---

*To the Charles River Basin Commission.*

GENTLEMEN:—The following is a report of the work of the engineering department for the portion of a year ending Sept. 30, 1903.

The chief engineer was appointed on August 21, and assumed the duties of his position on September 28; but previous to that time he had, acting under the instructions of your commission, given some attention to the fitting up of the rooms in the Standish building, at 367 Boylston Street, assigned to the engineering department, and to the organization of the engineering force.

On September 8 Mr. John N. Ferguson was appointed assistant engineer, and Miss Jennie L. Rawson stenographer and clerk. Mr. Ferguson and Miss Rawson began their duties on the following day.

Two division engineers have been appointed: Mr. John L. Howard, who will have charge of surveys, construction and other field work; and Mr. Frank E. Winsor, who will have charge of the designing, drafting and other office work. Mr. Howard reported for duty on September 28, but Mr. Winsor had not reported during the time covered by this report.

The total engineering force on September 30 was 4.

The principal work of the engineering department has consisted of fitting up the offices; selecting engineering and drafting instruments and tools; purchasing furniture and stationery supplies; collecting plans, reports and other data from the former secretary of the committee on the Charles River dam, and from other sources; organizing the engineering force; making plans of a vault to be con-

structed in the basement of the Standish building ; and arranging for records of the traffic through Craigie bridge draw, and for starting a boring force at the site of the dam and lock.

These borings are being made by the ordinary wash drill method. An outside pipe, called the "casing pipe," is driven into the ground. The material inside the pipe is washed up by a jet of water forced by a hand pump through a smaller interior pipe, known as the "wash pipe," to the bottom of the boring, the action of the water being assisted by a chisel-pointed tool attached to the end of the wash pipe. Unwashed samples of the material through which the boring is made are taken about every five feet, or whenever the material changes, and are obtained by substituting for the cutting tool at the end of the wash pipe a short pipe with the lower end open, which is driven into the bottom of the boring ; or, in case the material will not adhere to the side of the pipe, a valve is provided at the lower end, to close when the pipe is lifted.

The boring force began work on September 29, and has completed one boring, 56.3 feet in depth.

Respectfully submitted,

HIRAM A. MILLER,

*Chief Engineer.*

BOSTON, Jan. 1, 1904.

## APPENDIX.

---

[CHAPTER 465 OF THE ACTS OF THE YEAR 1903.]

**AN ACT TO AUTHORIZE THE CONSTRUCTION OF A DAM  
ACROSS THE CHARLES RIVER BETWEEN THE CITIES OF  
BOSTON AND CAMBRIDGE.**

*Be it enacted, etc., as follows :*

**SECTION 1.** The governor of the Commonwealth, with the advice and consent of the council, shall appoint three commissioners, residents of the metropolitan parks district, who shall constitute the Charles river basin commission, hereinafter called the commission, and who shall be sworn before entering upon the duties of their office. One commissioner shall be designated by the governor as chairman, and two commissioners shall constitute a quorum. The term of office shall be three years, and all vacancies shall be filled by the governor, with the advice and consent of the council. Any commissioner may be removed by the governor, with the advice and consent of the council, for such cause as he shall deem sufficient and shall assign in the order of removal. Each commissioner shall receive an annual salary of such amount as the governor and council shall determine.

Charles river  
basin  
commission,  
appointment,  
term, etc.

Compensation.

**SECTION 2.** The commission may appoint a secretary, engineers and assistants, shall keep accurate accounts of its expenditures, and shall make an annual report of its doings, including an abstract of its accounts, to the governor and council. The commission, whenever the Commonwealth has been authorized by the United States to build a dam and lock under the provisions of this act, shall proceed to do the work herein required of it, and shall in the meantime make examinations and plans therefor.

Powers and  
duties.

**SECTION 3.** The commission shall construct across Charles river, between the cities of Boston and Cam-

Dam to be  
constructed  
across Charles  
river, etc.

bridge, a dam, at least sufficiently high to hold back all tides and to maintain in the basin above the dam a substantially permanent water level not less than eight feet above Boston base. The dam shall occupy substantially the site of the present Craigie bridge, which shall be removed by the commission. The dam shall be not less than one hundred feet in width at said water level, and a part thereof shall be a highway and the remainder shall be a highway, or a park or parkway, as the commission shall determine. The dam shall be furnished with a lock not less than three hundred and fifty feet in length between the gates, forty feet in width and thirteen feet in depth below Boston base, and shall be built with a suitable draw-bridge or drawbridges, wasteways and other appliances. The part of the dam used as a highway shall be maintained and operated in the same manner as the Cambridge bridge, and under the laws now or hereafter in force relating to said bridge.

Navigable  
channels to be  
dredged.

SECTION 4. The commission shall dredge navigable channels in the basin from the lock to the wharves between the dam and Cambridge bridge, to Broad canal and to Lechmere canal, the channel to be not less than one hundred feet in width and eighteen feet in depth; shall dredge Broad canal to such depths as will afford to and at the wharves thereon not less than seventeen feet of water up to the Third street draw, not less than thirteen feet of water from the Third street draw to the Sixth street draw, and not less than eleven feet of water from the Sixth street draw to the railroad draw, and not less than nine feet of water for one hundred and twenty-five feet above the railroad draw; shall dredge Lechmere canal to such depths as will afford to and at the wharves thereon not less than seventeen feet of water up to and including Sawyer's lumber wharf, and not less than thirteen feet of water from said wharf up to the head of the canal at Bent street; all depths aforesaid to be measured from the water level to be maintained in the basin.

Manner of  
dredging, etc.

The commission shall do all such dredging and all strengthening of the walls of the canals and of the basin where dredging is done by the driving of prime oak piles

two feet on centres along the front of said wharves or walls, and all removing and relocating of pipes and conduits made necessary by such dredging, so that vessels requiring a depth of water not exceeding the respective depths above prescribed can lie alongside of, and in contact with, the wharves; and this work shall be done in such manner as to cause the least possible inconvenience to abutters, and shall be finished on or before the completion of the dam; and after the walls or wharves have been so strengthened, all repairs on or rebuilding of the walls and wharves shall be done by the abutters.

The commission shall do such dredging in the basin outside of the channels aforesaid as may be necessary for the removal of sewage, sludge or any offensive deposit; shall do such other dredging as it shall deem proper, and shall take all proper measures for the destruction of malarial mosquitoes in the basin and its vicinity.

Certain other dredging to be done, etc.

SECTION 5. The commission, before the completion of the dam, shall construct marginal conduits on the north side of the basin from the outlet of the overflow channel in Binney street to a point below the dam, and on the south side of the basin from the present outlet of the Back Bay Fens to a point below the dam, and may construct an extension thereof toward, or to, St. Mary street, the conduits to be used to receive and conduct below the dam the overflow from sewers and the surface drainage and other refuse matter which would otherwise pass into the basin.

Marginal conduits to be constructed, etc.

SECTION 6. The commission, for the purpose of carrying out the provisions of the preceding sections, may from time to time take in fee or otherwise, by purchase or otherwise, for the Commonwealth, or the city of Boston or the city of Cambridge, as the commission shall determine, lands, flats and lands covered by tide water on Charles river, by filing in the registry of deeds for the county and district in which the lands or flats are situated a description thereof, sufficiently accurate for identification, signed by a majority of the commissioners; and any person whose property is so taken may have compensation therefor as determined by agreement with the commission,

Certain lands, etc., may be taken, etc.

and if they cannot agree, the compensation may be determined by a jury in the superior court for the county where the property is situated under the same provisions of law, so far as they are applicable, which apply in determining the value of lands taken for highways under chapter forty-eight of the Revised Laws, upon petition therefor by the commission, or by such person, filed in the clerk's office of said court against the Commonwealth or the city for which the lands or flats are taken within one year after the taking, and costs shall be taxed and execution issued as in civil cases.

The metro-  
politan park  
commission to  
have exclusive  
control of dam,  
etc.

May make  
rules and  
regulations,  
etc.

Notice to be  
given in case  
of emergency  
requiring  
temporary  
reduction of  
level, etc.

Removal of  
direct sewage  
or factory  
waste may be  
ordered, etc.

SECTION 7. The metropolitan park commission, when the work provided for in the preceding sections is finished, shall, subject to the powers vested by law in the state board of health, have exclusive control of the dam and lock and of the basin and river between the dam and the city of Waltham, as a part of the metropolitan parks system, and of all poles, wires and other structures placed or to be placed on, across, over or in any part of said basin, dam or lock, and of the placing thereof, except the part of the dam used as a highway and the bridges and other structures erected by any city or town within its limits and upon its own lands; may make reasonable rules and regulations, not impairing freight traffic, for the care, maintenance, protection and policing of the basin; and throughout the year shall operate the lock without charge, maintain the lock, channels and canals aforesaid at the depths aforesaid, and clear of obstructions caused by natural shoaling or incident to the building of the dam, and maintain the water in the basin at such level, and the lock, channels and canals sufficiently clear of obstructions by ice so that any vessel ready to pass through the lock, and requiring no more depth of water than aforesaid, can pass through to the wharves aforesaid. In the event of an emergency, requiring the temporary reduction of such level, notice thereof shall be given to the occupants of said wharves, and such reduction shall not be lower nor continue longer than the emergency requires. Said metropolitan park commission may order the removal of all direct sewage or factory waste as a common nuisance

from the river and its tributaries below the city of Waltham; and no sewer, drain, overflow or other outlet for factory or house drainage shall hereafter be connected with the basin below said city without the approval of the metropolitan park commission.

SECTION 8. The Commonwealth shall in the first instance pay all expenses incurred in carrying out the provisions of the preceding sections, and the same shall, except as provided in the following section, constitute part of the cost of construction and maintenance of the metropolitan parks system; and in addition to the amounts heretofore authorized for such construction the treasurer and receiver-general shall, from time to time, as authorized by the governor and council, issue notes, bonds or scrip, in the name and behalf of the Commonwealth, entitled Charles River Basin Loan, to the amount which the commission may deem necessary for the expenses incurred under the first six sections of this act; and all acts and parts of acts relative to loans for such construction and providing for their payment shall, so far as they may be applicable and not inconsistent herewith, apply to such notes, bonds and scrip and to their payment.

Payment of expenses.

Charles River Basin Loan.

SECTION 9. The commissioners next appointed under the provisions of chapter four hundred and nineteen of the acts of the year eighteen hundred and ninety-nine, and amendments thereof, in apportioning the expenses of maintaining the metropolitan parks system shall include as part thereof the expense of maintenance incurred under the preceding sections of this act; shall also determine, as they shall deem just and equitable, what portion of the total amount expended for construction under sections three, four, five and six of this act shall be apportioned to the cities of Boston and Cambridge as the cost of the removal of Craigie bridge and the construction of a suitable bridge in place thereof, and the remainder shall be considered and treated as part of the cost of construction of the metropolitan park system. The treasurer and receiver-general shall determine the payments to be made each year by said cities, one-half by each, to meet the interest and sinking fund require-

Apportionment of expenses, etc.



ments for the amounts apportioned to them as the cost of such bridge, and the same shall be paid by each city into the treasury of the Commonwealth as part of its state tax.

City of Boston  
to do certain  
dredging,  
construct  
conduits,  
sewer, etc.

SECTION 10. The city of Boston, by such officer or officers as the mayor may designate, shall forthwith after the passage of this act do such dredging in the Back Bay Fens as the board of health of said city may require; shall construct a conduit between Huntington avenue and Charles river, to form an outlet into Charles river for the commissioners' channel of Stony brook; shall reconstruct the present connections between the river and the Fens so as to allow free access of water from the river into the streams and ponds in the Fens and thence into the river; and shall construct a sewer in the rear of the houses on the north side of Beacon street between Otter and Hereford streets. Such officer or officers may construct a conduit between Green street and Forest Hills, and may construct or rebuild within five years one or more conduits for Stony brook between the westerly side of Elmwood street and the Fens: *provided, however*, that the expense of such conduits between Green street and Forest Hills and between Elmwood street and the Fens shall be paid for out of the annual appropriation for sewer construction, under the provisions of chapter four hundred and twenty-six of the acts of the year eighteen hundred and ninety-seven and acts in amendment thereof or in addition thereto.

Proviso.

Wall or  
embankment  
may be built  
on Boston side  
of Charles  
river.

SECTION 11. The board of park commissioners of Boston may, with the approval of the mayor, build a wall or embankment on the Boston side of Charles river, beginning at a point in the southwest corner of the stone wall of the Charlesbank, thence running southerly by a straight or curved line to a point in Charles river not more than three hundred feet distant westerly from the harbor commissioners' line, measuring on a line perpendicular to the said commissioners' line at its intersection with the southerly line of Mount Vernon street, but in no place more than three hundred feet westerly from said commissioners' line; thence continuing southerly and

westerly by a curved line to a point one hundred feet or less from the wall in the rear of Beacon street; thence by a line substantially parallel with said wall to the easterly line of the Back Bay Fens, extended to intersect said parallel line.

SECTION 12. The board of park commissioners of said city may take, in fee or otherwise, by purchase or otherwise, for said city, for the purpose of a public park such lands, flats and lands covered by tide water between Charles, Brimmer and Back streets and the line of the wall or embankment aforesaid, as the mayor shall approve, by filing in the registry of deeds for the county of Suffolk a description thereof sufficiently accurate for identification, signed by a majority of the commissioners, and shall construct a public park on the lands so taken; and any person whose property is so taken may have compensation therefor as determined by agreement with the board, and if they cannot agree, the amount thereof may be determined by a jury in the superior court for the county of Suffolk, under the same provisions of law, so far as they may be applicable, which apply in determining the value of lands taken for highways under chapter forty-eight of the Revised Laws, upon petition therefor by the board, or by such person, filed in the clerk's office of said court against said city within one year after the taking, and costs shall be taxed and execution issued as in civil cases.

Certain lands, flats, etc., may be taken for a public park.

SECTION 13. The city of Boston shall pay the expenses incurred under sections ten, eleven and twelve of this act, except as otherwise provided in section ten of this act; and to meet said expenses the city treasurer of the city shall, from time to time, on the request of the mayor, issue and sell bonds of the city to an amount not exceeding eight hundred thousand dollars, and the bonds so issued shall not be reckoned in determining the legal limit of indebtedness of the city.

City of Boston to pay certain expenses, etc.

City treasurer to issue bonds, etc.

SECTION 14. The lock shall be built above the lower line of the dam, and the Boston and Maine Railroad shall, before the dam is completed, remove its bridge, piles and any other structures in Charles river which are southerly

The Boston and Maine Railroad to remove certain structures, etc.

or westerly of a line defined in red on a plan filed in the office of the board of harbor and land commissioners, marked "Plan showing line from above or southwest of which the Boston & Maine Railroad shall remove all of its structures in Charles River and between the harbor lines, May 25, 1903. Woodward Emery, Chairman of Harbor and Land Commissioners"; and may rebuild the same northerly and easterly of the line so defined. The draw in the new bridge shall not be easterly of nor more than fifty feet westerly from the location of the present draw, and shall be so located as to be directly opposite the lock. Within the limits herein prescribed the commission shall determine the position of the lock and draw.

Enforcement  
of provisions  
of act, etc.

SECTION 15. The supreme judicial court and the superior court shall, upon application of any party in interest, including any owner or occupant of property abutting on the basin or on Broad canal or Lechmere canal, have jurisdiction to enforce, or prevent violation of, any provision of this act, and any order, rule or regulation made under authority thereof.

Repeal.

SECTION 16. Chapter three hundred and forty-four of the acts of the year eighteen hundred and ninety-one, as amended by section one of chapter four hundred and thirty-five of the acts of the year eighteen hundred and ninety-three, and chapter five hundred and thirty-one of the acts of the year eighteen hundred and ninety-eight are hereby repealed.

When to take  
effect.

SECTION 17. This act shall take effect on the first day of July in the year nineteen hundred and three. [*Approved June 24, 1903.*]

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bridge, a dam, at least sufficiently high to hold back all tides and to maintain in the basin above the dam a substantially permanent water level not less than eight feet above Boston base. The dam shall occupy substantially the site of the present Craigie bridge, which shall be removed by the commission. The dam shall be not less than one hundred feet in width at said water level, and a part thereof shall be a highway and the remainder shall be a highway, or a park or parkway, as the commission shall determine. The dam shall be furnished with a lock not less than three hundred and fifty feet in length between the gates, forty feet in width and thirteen feet in depth below Boston base, and shall be built with a suitable draw-bridge or drawbridges, wasteways and other appliances. The part of the dam used as a highway shall be maintained and operated in the same manner as the Cambridge bridge, and under the laws now or hereafter in force relating to said bridge.

Navigable  
channels to be  
dredged.

SECTION 4. The commission shall dredge navigable channels in the basin from the lock to the wharves between the dam and Cambridge bridge, to Broad canal and to Lechmere canal, the channel to be not less than one hundred feet in width and eighteen feet in depth; shall dredge Broad canal to such depths as will afford to and at the wharves thereon not less than seventeen feet of water up to the Third street draw, not less than thirteen feet of water from the Third street draw to the Sixth street draw, and not less than eleven feet of water from the Sixth street draw to the railroad draw, and not less than nine feet of water for one hundred and twenty-five feet above the railroad draw; shall dredge Lechmere canal to such depths as will afford to and at the wharves thereon not less than seventeen feet of water up to and including Sawyer's lumber wharf, and not less than thirteen feet of water from said wharf up to the head of the canal at Bent street; all depths aforesaid to be measured from the water level to be maintained in the basin.

er of  
ing, etc.

The commission shall do all such dredging and all strengthening of the walls of the canals and of the basin where dredging is done by the driving of prime oak piles

two feet on centres along the front of said wharves or walls, and all removing and relocating of pipes and conduits made necessary by such dredging, so that vessels requiring a depth of water not exceeding the respective depths above prescribed can lie alongside of, and in contact with, the wharves; and this work shall be done in such manner as to cause the least possible inconvenience to abutters, and shall be finished on or before the completion of the dam; and after the walls or wharves have been so strengthened, all repairs on or rebuilding of the walls and wharves shall be done by the abutters.

The commission shall do such dredging in the basin outside of the channels aforesaid as may be necessary for the removal of sewage, sludge or any offensive deposit; shall do such other dredging as it shall deem proper, and shall take all proper measures for the destruction of malarial mosquitoes in the basin and its vicinity.

Certain other dredging to be done, etc.

SECTION 5. The commission, before the completion of the dam, shall construct marginal conduits on the north side of the basin from the outlet of the overflow channel in Binney street to a point below the dam, and on the south side of the basin from the present outlet of the Back Bay Fens to a point below the dam, and may construct an extension thereof toward, or to, St. Mary street, the conduits to be used to receive and conduct below the dam the overflow from sewers and the surface drainage and other refuse matter which would otherwise pass into the basin.

Marginal conduits to be constructed, etc.

SECTION 6. The commission, for the purpose of carrying out the provisions of the preceding sections, may from time to time take in fee or otherwise, by purchase or otherwise, for the Commonwealth, or the city of Boston or the city of Cambridge, as the commission shall determine, lands, flats and lands covered by tide water on Charles river, by filing in the registry of deeds for the county and district in which the lands or flats are situated a description thereof, sufficiently accurate for identification, signed by a majority of the commissioners; and any person whose property is so taken may have compensation therefor as determined by agreement with the commission,

Certain lands, etc., may be taken, etc.

and if they cannot agree, the compensation may be determined by a jury in the superior court for the county where the property is situated under the same provisions of law, so far as they are applicable, which apply in determining the value of lands taken for highways under chapter forty-eight of the Revised Laws, upon petition therefor by the commission, or by such person, filed in the clerk's office of said court against the Commonwealth or the city for which the lands or flats are taken within one year after the taking, and costs shall be taxed and execution issued as in civil cases.

The metropolitan park commission to have exclusive control of dam, etc.

May make rules and regulations, etc.

Notice to be given in case of emergency requiring temporary reduction of level, etc.

Removal of direct sewage or factory waste may be ordered, etc.

SECTION 7. The metropolitan park commission, when the work provided for in the preceding sections is finished, shall, subject to the powers vested by law in the state board of health, have exclusive control of the dam and lock and of the basin and river between the dam and the city of Waltham, as a part of the metropolitan parks system, and of all poles, wires and other structures placed or to be placed on, across, over or in any part of said basin, dam or lock, and of the placing thereof, except the part of the dam used as a highway and the bridges and other structures erected by any city or town within its limits and upon its own lands; may make reasonable rules and regulations, not impairing freight traffic, for the care, maintenance, protection and policing of the basin; and throughout the year shall operate the lock without charge, maintain the lock, channels and canals aforesaid at the depths aforesaid, and clear of obstructions caused by natural shoaling or incident to the building of the dam, and maintain the water in the basin at such level, and the lock, channels and canals sufficiently clear of obstructions by ice so that any vessel ready to pass through the lock, and requiring no more depth of water than aforesaid, can pass through to the wharves aforesaid. In the event of an emergency, requiring the temporary reduction of such level, notice thereof shall be given to the occupants of said wharves, and such reduction shall not be lower nor continue longer than the emergency requires. Said metropolitan park commission may order the removal of all direct sewage or factory waste as a common nuisance

from the river and its tributaries below the city of Waltham; and no sewer, drain, overflow or other outlet for factory or house drainage shall hereafter be connected with the basin below said city without the approval of the metropolitan park commission.

SECTION 8. The Commonwealth shall in the first instance pay all expenses incurred in carrying out the provisions of the preceding sections, and the same shall, except as provided in the following section, constitute part of the cost of construction and maintenance of the metropolitan parks system; and in addition to the amounts heretofore authorized for such construction the treasurer and receiver-general shall, from time to time, as authorized by the governor and council, issue notes, bonds or scrip, in the name and behalf of the Commonwealth, entitled Charles River Basin Loan, to the amount which the commission may deem necessary for the expenses incurred under the first six sections of this act; and all acts and parts of acts relative to loans for such construction and providing for their payment shall, so far as they may be applicable and not inconsistent herewith, apply to such notes, bonds and scrip and to their payment.

Payment of expenses.

Charles River Basin Loan.

SECTION 9. The commissioners next appointed under the provisions of chapter four hundred and nineteen of the acts of the year eighteen hundred and ninety-nine, and amendments thereof, in apportioning the expenses of maintaining the metropolitan parks system shall include as part thereof the expense of maintenance incurred under the preceding sections of this act; shall also determine, as they shall deem just and equitable, what portion of the total amount expended for construction under sections three, four, five and six of this act shall be apportioned to the cities of Boston and Cambridge as the cost of the removal of Craigie bridge and the construction of a suitable bridge in place thereof, and the remainder shall be considered and treated as part of the cost of construction of the metropolitan park system. The treasurer and receiver-general shall determine the payments to be made each year by said cities, one-half by each, to meet the interest and sinking fund require-

Apportionment of expenses, etc.



ments for the amounts apportioned to them as the cost of such bridge, and the same shall be paid by each city into the treasury of the Commonwealth as part of its state tax.

City of Boston  
to do certain  
dredging,  
construct  
conduits,  
sewer, etc.

SECTION 10. The city of Boston, by such officer or officers as the mayor may designate, shall forthwith after the passage of this act do such dredging in the Back Bay Fens as the board of health of said city may require; shall construct a conduit between Huntington avenue and Charles river. to form an outlet into Charles river for the commissioners' channel of Stony brook; shall reconstruct the present connections between the river and the Fens so as to allow free access of water from the river into the streams and ponds in the Fens and thence into the river; and shall construct a sewer in the rear of the houses on the north side of Beacon street between Otter and Hereford streets. Such officer or officers may construct a conduit between Green street and Forest Hills, and may construct or rebuild within five years one or more conduits for Stony brook between the westerly side of Elmwood street and the Fens: *provided, however,* that the expense of such conduits between Green street and Forest Hills and between Elmwood street and the Fens shall be paid for out of the annual appropriation for sewer construction, under the provisions of chapter four hundred and twenty-six of the acts of the year eighteen hundred and ninety-seven and acts in amendment thereof or in addition thereto.

Proviso.

Wall or  
embankment  
may be built  
on Boston side  
of Charles  
river.

SECTION 11. The board of park commissioners of Boston may, with the approval of the mayor, build a wall or embankment on the Boston side of Charles river, beginning at a point in the southwest corner of the stone wall of the Charlesbank, thence running southerly by a straight or curved line to a point in Charles river not more than three hundred feet distant westerly from the harbor commissioners' line, measuring on a line perpendicular to the said commissioners' line at its intersection with the southerly line of Mount Vernon street, but in no place more than three hundred feet westerly from said commissioners' line; thence continuing southerly and

westerly by a curved line to a point one hundred feet or less from the wall in the rear of Beacon street; thence by a line substantially parallel with said wall to the easterly line of the Back Bay Fens, extended to intersect said parallel line.

SECTION 12. The board of park commissioners of said city may take, in fee or otherwise, by purchase or otherwise, for said city, for the purpose of a public park such lands, flats and lands covered by tide water between Charles, Brimmer and Back streets and the line of the wall or embankment aforesaid, as the mayor shall approve, by filing in the registry of deeds for the county of Suffolk a description thereof sufficiently accurate for identification, signed by a majority of the commissioners, and shall construct a public park on the lands so taken; and any person whose property is so taken may have compensation therefor as determined by agreement with the board, and if they cannot agree, the amount thereof may be determined by a jury in the superior court for the county of Suffolk, under the same provisions of law, so far as they may be applicable, which apply in determining the value of lands taken for highways under chapter forty-eight of the Revised Laws, upon petition therefor by the board, or by such person, filed in the clerk's office of said court against said city within one year after the taking, and costs shall be taxed and execution issued as in civil cases.

Certain lands, flats, etc., may be taken for a public park.

SECTION 13. The city of Boston shall pay the expenses incurred under sections ten, eleven and twelve of this act, except as otherwise provided in section ten of this act; and to meet said expenses the city treasurer of the city shall, from time to time, on the request of the mayor, issue and sell bonds of the city to an amount not exceeding eight hundred thousand dollars, and the bonds so issued shall not be reckoned in determining the legal limit of indebtedness of the city.

City of Boston to pay certain expenses, etc.

City treasurer to issue bonds, etc.

SECTION 14. The lock shall be built above the lower line of the dam, and the Boston and Maine Railroad shall, before the dam is completed, remove its bridge, piles and any other structures in Charles river which are southerly

The Boston and Maine Railroad to remove certain structures, etc.

or westerly of a line defined in red on a plan filed in the office of the board of harbor and land commissioners, marked "Plan showing line from above or southwest of which the Boston & Maine Railroad shall remove all of its structures in Charles River and between the harbor lines, May 25, 1903. Woodward Emery, Chairman of Harbor and Land Commissioners"; and may rebuild the same northerly and easterly of the line so defined. The draw in the new bridge shall not be easterly of nor more than fifty feet westerly from the location of the present draw, and shall be so located as to be directly opposite the lock. Within the limits herein prescribed the commission shall determine the position of the lock and draw.

Enforcement  
of provisions  
of act, etc.

SECTION 15. The supreme judicial court and the superior court shall, upon application of any party in interest, including any owner or occupant of property abutting on the basin or on Broad canal or Lechmere canal, have jurisdiction to enforce, or prevent violation of, any provision of this act, and any order, rule or regulation made under authority thereof.

Repeal.

SECTION 16. Chapter three hundred and forty-four of the acts of the year eighteen hundred and ninety-one, as amended by section one of chapter four hundred and thirty-five of the acts of the year eighteen hundred and ninety-three, and chapter five hundred and thirty-one of the acts of the year eighteen hundred and ninety-eight are hereby repealed.

When to take  
effect.

SECTION 17. This act shall take effect on the first day of July in the year nineteen hundred and three. [*Approved June 24, 1903.*]

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SECOND ANNUAL REPORT

OF THE

CHARLES RIVER BASIN  
COMMISSION.

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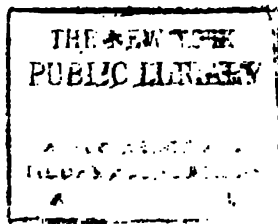
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WRIGHT & POTTER PRINTING CO., STATE PRINTERS,  
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BASIN.

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# Commonwealth of Massachusetts.

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## SECOND REPORT OF THE COMMISSION.

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*To His Excellency the Governor and the Honorable Council of the Commonwealth of Massachusetts.*

The Commission appointed under chapter 465 of the Acts of the year 1903, and termed the Charles River Basin Commission, has the honor to make the following report of its proceedings and expenditures, in accordance with section 2 of the act establishing the Commission. As required by section 5 of chapter 9 of the Revised Laws of Massachusetts, this report is for the year ending Sept. 30, 1904.

### THE DAM AND LOCK.

The preparation of the plans and specifications for the dam and lock has been the foremost matter receiving the attention of the Commission and its force of engineers throughout the year. To secure a safe construction of the dam and lock, in a form which would be likely to prove satisfactory for many years to come, involved some unusual features of engineering, which required a development of the entire plan of construction before any contracts could be let, and involved the necessity of going minutely into details of all plans to be submitted to contractors. The engineers have, nevertheless, made excellent progress. The Commission is nearly ready to make a preliminary announcement of the quantities involved in the first contract, — that for the main portion of the dam and lock. The plans and specifications for this contract are more fully described in the engineer's report, attached hereto. It is expected that bids for this contract will be opened in December.

1904, and if all goes well, the contract will probably be let by the beginning of 1905. A perspective plan, in colors, of the dam and its appurtenances, substantially as the same will appear when the work of the Commission has been completed, was sent to the St. Louis Exposition, and was exhibited in the Massachusetts building. This plan was the means of attracting widespread interest in the proposed Charles River basin among engineers, both American and foreign. A cut made from a photograph of the plan appears at the beginning of this report.

After careful investigation and report by its engineers, the Commission voted to establish, as the minimum grade for the permanent level of the basin, the grade of 8 feet above Boston base, or about  $2\frac{1}{2}$  feet below the average high tide.

#### THE MARGINAL CONDUITS.

The marginal conduits, both on the Boston and Cambridge sides of the river, are receiving the attention of the Commission and its engineers; but, since they admit of faster construction than the dam and lock, the contract for the latter is to be let first. Work upon the plans for the conduits is proceeding satisfactorily. There are two pieces of work to be done by the city of Boston which have an important relation to the marginal conduit on the Boston side. The first is the work of constructing the wall and embankment or parkway in the rear of Beacon and Brimmer streets, as provided in chapter 465 of the Acts of 1903. If the building of this wall by the city is contemporaneous with the Commission's work on the conduit, a great saving of expense will be secured, both to the city and to the Commonwealth. The second piece of work is that of establishing a separate system of sewerage in the Back Bay district. This plan has received the recommendation of the present mayor of Boston, and, if carried out, will be a great help toward securing satisfactory conditions in the Charles River basin.

#### THE LICENSE OF THE WAR DEPARTMENT.

*Whereas*, the Charles River Basin Commission, having authority of the Legislature of the State of Massachusetts to construct a dam, lock and draw, and to dredge canals and channels in the Charles





CORNER OF WALL, REAR OF BEACON AND BRIMMER STREETS.

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ASTOR LENOX AND  
TILDEN FOUNDATIONS



River, at Boston, Massachusetts, in accordance with the provisions of an Act of the General Court of the Commonwealth of Massachusetts, approved June 24, 1903, entitled "An Act to authorize the construction of a dam across the Charles River between the cities of Boston and Cambridge" (Acts and Resolves of Massachusetts, 1903, pages 495-501), has submitted to the Secretary of War, for his examination and approval, drawings showing the locations and general plans of the dimensions of such structures and works;

*Now, therefore,* This is to certify that the Secretary of War, under authority of Sections 9 and 10 of the River and Harbor Act of March 3, 1899 (30 Stat. L., 1151), and in accordance with the recommendation of the Chief of Engineers, United States Army, hereby approves the locations and general plans of said dam, lock and draw, as shown on the said drawings, which are hereto attached, and hereby authorizes the dredging of the canals and channels indicated thereon; subject, however, to the following express conditions and limitations, viz.:—

1. That detailed plans for the lock and dam, and of all channels to be dredged outside established harbor lines, shall be submitted to the Secretary of War, and that the work be not begun until such plans have received his approval.

2. That the Charles River Basin Commission, or its successors, shall operate the lock, at their own expense, as a free navigable waterway of the United States, subject to such regulations as the Secretary of War may promulgate.

3. That the emptying of the basin shall be subject to regulation by the Secretary of War.

4. That the Charles River Basin Commission shall dredge and maintain in the basin, from the head of the lock to the channel in the river, a channel 100 feet wide and 18 feet deep at mean low water, in a location to be approved by the Secretary of War.

5. That whenever called upon to do so by the Secretary of War, the Charles River Basin Commission shall deepen 2.2 feet the channel 80 feet wide called for by the present approved project for the improvement of Charles River by the United States, known as the project of June 14, 1880, the said deepening to extend as far as Brackett's wharf.

6. That the Charles River Basin Commission shall maintain in the Charles River, from the head of the 35-foot channel at Charles River bridge to the dam and lock, the necessary depth and width of channel for the commerce of the river, as fixed by the Secretary of War.

7. That the alterations in the bridge of the Boston and Maine Railroad Company ordered by said Act of the General Court of

Massachusetts shall be made, approval of the plans by the Secretary of War being obtained, as required by law.

8. That the approval hereby granted shall not be construed as authorizing any invasion of property rights, or any act whereby a claim for damages against the United States might arise.

Witness my hand this 18th day of May, 1904.

ROBERT SHAW OLIVER,  
*Acting Secretary of War.*

On the sixth day of September the Commission submitted its detail plans for the dam and lock.

#### LEGISLATION OF 1904.

Upon the request of the Commission, His Excellency John L. Bates sent a message to the Legislature, recommending that the Commonwealth accept the conditions laid down by the War Department. In accordance with the Governor's recommendation, the Legislature passed chapter 107 of the Resolves of 1904, a copy of which will be found in Appendix B of this report.

#### THE TEMPORARY HIGHWAY BRIDGE.

The Commission is required, by section 3 of chapter 465 of the Acts of 1903, to remove Craigie bridge; and it is essential to the satisfactory progress of the work of building the dam that portions of the bridge shall be removed within a reasonably short time after the contractor for the dam and lock begins his work. Traffic over Craigie bridge is large, and of great importance to many citizens of the Commonwealth; the Commission has therefore felt the necessity of providing for the continuance of the traffic without interruption during the process of building the dam. To have built a temporary bridge on the upper side of Craigie bridge would have been very expensive and somewhat inconvenient; three drawbridges would have been necessary in such a bridge.

A fortunate solution to the problem was found when the officials of the Boston & Maine Railroad consented to allow the Commission to use the Boston & Lowell freight bridge, next below Craigie bridge, which, under chapter 465 of the Acts of 1903, the railroad is ordered to remove. By the construction





CITY OF BOSTON SEWER WORK IN REAR OF BEACON STREET.



of short approaches to Bridge Street in Cambridge and Leverett Street in Boston, and some reconstruction of the railroad bridge, a better highway than the present Craigie bridge can be secured for traffic. The Commission's plans for such use of the railroad bridge have already received the approval of the Secretary of War.

#### ADDITIONAL LEGISLATION NEEDED.

Though the Legislature has granted to the Commission broad powers relating to the construction of the dam and lock, some doubt has been expressed as to the Commission's authority to do the work necessary to utilize the Boston & Maine Railroad's freight bridge as a temporary highway bridge. The Attorney-General, in an opinion dated Aug. 5, 1904, thus advises the Commission: "The suggested temporary bridge would be, in my opinion, a technical interference with the right of navigation, and in violation of the strict statutory provisions relating to tide water."

Acting upon the advice above stated, the Commission hereby requests and recommends that the Legislature give it authority to contract with the Boston & Maine Railroad for the use of its bridge, to add to and reconstruct the same for highway purposes, to erect in tide water such piles and other structures as may be necessary for the purposes above stated, and to remove the same upon the completion of the dam.

#### HEARINGS.

During the year the Commission has held several important hearings, as follows:—

On January 26, March 8, April 25 and June 22, delegations representing the owners of wharves on the basin and on the Broad and Lechmere canals were heard upon the question of the width and depth of the lock. An agreement was finally reached, establishing the width at 45 feet and the depth at 3.4 feet deeper than the minimum requirement of chapter 465 of the Acts of 1903, making a total depth of 17 feet below mean low-water mark, which depth was approved by Col. W. S. Stanton, representing the War Department.



On February 2, the mayor and others representing the city of Boston appeared before the Commission to ask it not to build the marginal conduit on the Boston side. Citizens representing the property owners on the north side of Beacon Street appeared as remonstrants to the proposition made by the mayor.

On August 1, Frederic D. Fisk *et als.*, trustees of the Main Street Land Trust, appeared and requested the Commission to make a taking of their gravel bank in the vicinity of the new Cambridge bridge.

#### PROPOSED TAKING OF PROPERTY FOR APPROACHES.

In order to construct satisfactory approaches to its temporary bridge, and to properly connect the dam with the river bank on the Boston and Cambridge sides, the Commission finds it necessary to make a taking of certain property on the Boston side, claimed by Edward W. McGlenen *et al.*, and of certain property on the Cambridge side, belonging to George O. Proctor.

#### ISSUE OF BONDS.

On the fifteenth day of December, the Commission voted to advise the Treasurer of the Commonwealth to make available funds to the amount of \$250,000 for the year 1904. Bonds to the amount named were issued under the title of "The Charles River Basin Loan," and sold by the Treasurer. Of this sum the Commission expended, to and including Sept. 30, 1904, \$50,387.47.

#### PAYMENTS TO THE SINKING FUND.

Payments to the sinking fund on the Charles River Basin Loan have been made to the amount of \$11,307.54.

#### GENERAL STATEMENT.

On July 25, William S. Youngman was appointed by the Commission to serve as its secretary.

The following additions were made to the engineering staff: —



ENTRANCE TO BROAD CANAL.

## REPORT OF THE CHIEF ENGINEER

*To the Charles River Basin Commission.*

GENTLEMEN : — The following is a report of the work of the engineering department for the year ending Sept. 30,

## ORGANIZATION.

Mr. John L. Howard continued as division engineer in charge of field work ; and on November 2 Mr. Frank E. Winthrop had been previously engaged, reported for duty as division engineer in charge of designing, drafting and other office work.

Mr. Frederic P. Stearns continued as consulting engineer.

Mr. Guy Lowell was consulted at intervals after January 1, 1904, in the study and design of features of the dam which required expert judgment in architecture and in mechanical architecture.

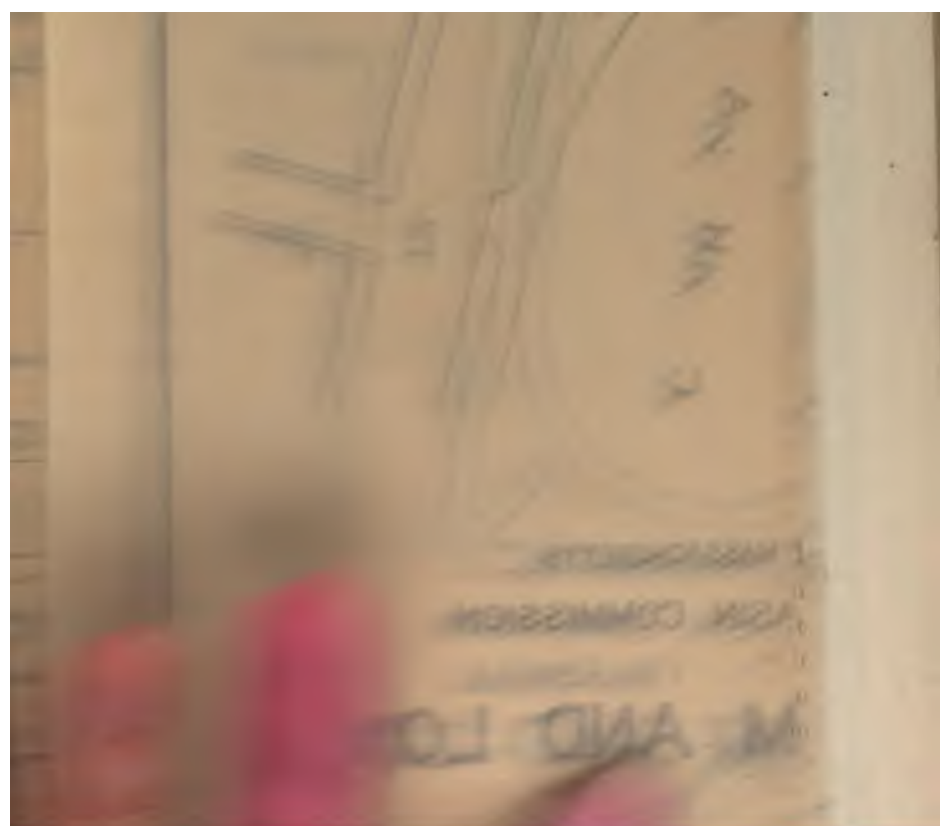
The engineering force at the beginning of the year numbered 14, and was increased from time to time as the work progressed until on August 22 it reached a maximum of 21. At the end of the year numbered 18.

The names of the assistants in the engineering department, not mentioned above, who have been employed for more than one month, are given below, with the positions held, together with an indication of the work performed.

*Assistant Engineers.*

JOHN N. FERGUSON,	.	.	Hydraulic studies and miscellaneous office work.
EDWARD C. SHERMAN,	.	.	Designs and drafting of steel work.
ARTHUR W. TIDD,	.	.	Designs and drafting of cast-iron pipes, etc.
LEONARD P. WOOD,	.	.	Hydraulic studies and office work.
J. ALBERT HOLMES,	.	.	Field work.





HERBERT H. HARRIS  
7 HAZEL STREET  
NEW YORK, N. Y.

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*Draftsmen, Instrumentmen, etc.*

WILLIAM C. PICKERING,	. Draftsman.
JENNIE L. RAWSON,	. Clerk and stenographer, — administrative work, accounts, letters, and compiling data.
WALTON H. SEARS,	. Mechanical assistant.
HERBERT W. OLMPSTED,	. Instrumentman.
MORTON F. SANBORN,	. Instrumentman.
FREDERIC C. H. EICHORN,	. Instrumentman.
ETHELIN B. MARLATTE,	. Clerk and stenographer.
ALBERT J. HOLMES,	. Draftsman.
ROBERT E. BARRETT,	. Rodman.
RALPH E. HADLEY,	. Rodman.
FRANK A. McDONALD,	. Rodman.
EDWARD L. LINCOLN,	. Rodman.
ALFRED WM. TREEN,	. Clerk and messenger.

## GENERAL STATEMENT.

As the previous report of this department covered a period of less than a month, the first work of the new year was to continue the organization of the engineering force; to purchase furniture, instruments and office supplies; to fit up the offices; and to make studies of the plans and data received from the committee on Charles River dam.

The danger of plans and records being destroyed by fire led to the early design and construction of a fire-proof vault, with fittings, in the basement of the Standish building. This vault is independent of the remainder of the building, is fitted with plan cases and book shelves, and is of sufficient size to provide for any plans, books or other records that may be used by the Commission.

## PERMANENT ELEVATION OF WATER IN THE BASIN.

After careful consideration, it was decided that the permanent elevation of the water in the basin should be established at 8 feet above Boston city base, or 7.36 feet above mean low water. This elevation will be used as a basis for dredging and other work; but as a rule, during the daily fluctuations at high tide the water will be permitted to rise above grade 8. It is possible, also, that the water will be allowed to rise two or three tenths of a foot above that elevation in the latter part of

the spring, and at other times when the water is available, to accumulate storage for dry periods.

The principal conditions which render a low grade desirable are the effects on ground water elevations, the more effective drainage of the marshes and other low lands along the river, the lower overflow openings in the Boston and Cambridge marginal conduits to take the sewer overflows in times of storm particularly at high tide, the lower grade that will be required for new bridges over the river, and the advantage in the probable future elimination of the grade crossings of the Boston & Albany Railroad in Cambridge.

#### DAM AND LOCK.

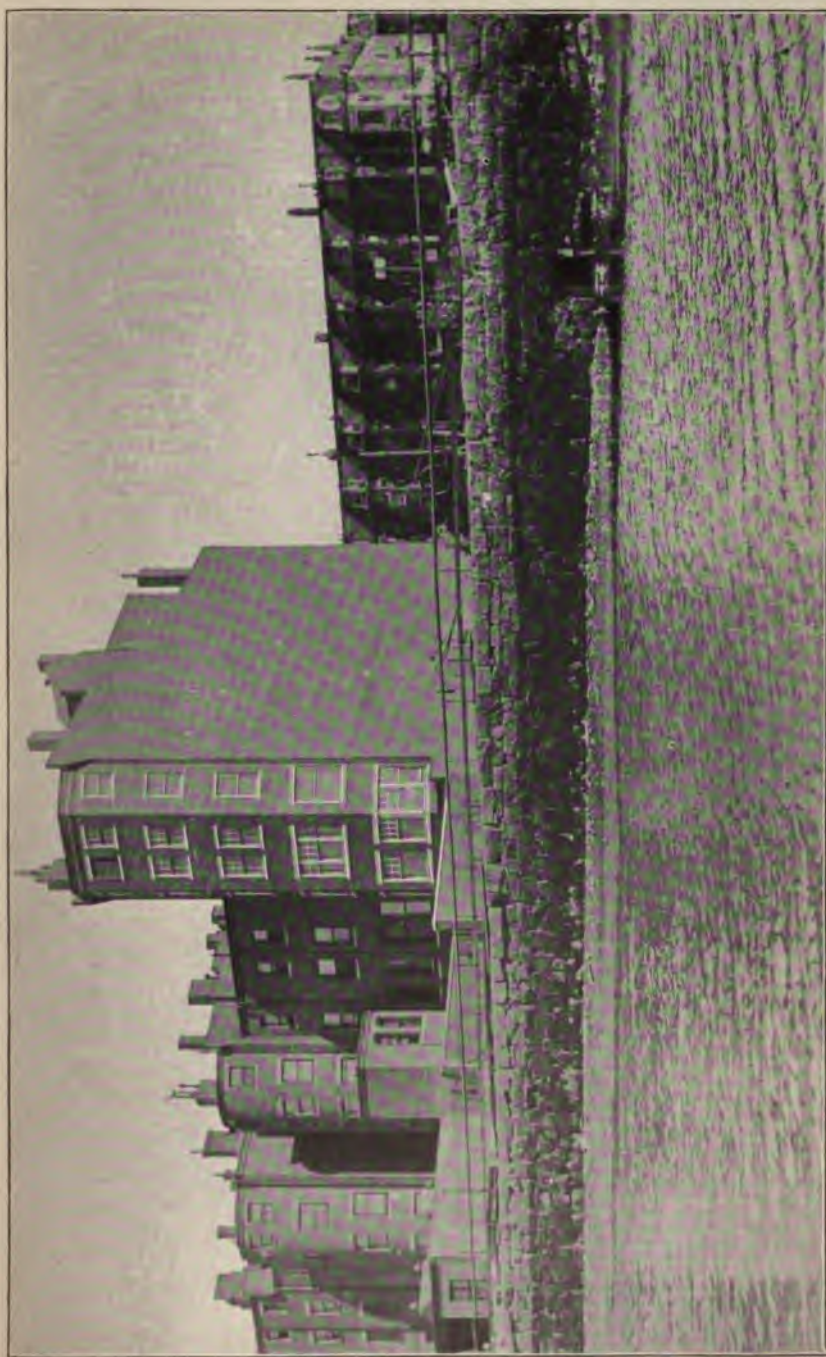
The construction of the dam forming, as it does, the most important part of the work to be done by the Commission, a somewhat detailed statement will be made of the various features of the dam as it is being designed, and of the preliminary work connected therewith.

#### *Approval of War Department.*

Section 2 of the act establishing the Commission provides that "The Commission, whenever the Commonwealth has been authorized by the United States to build a dam and lock under the provisions of this act, shall proceed to do the work herein required of it, and shall in the meantime make examinations and plans therefor."

Work was begun at once upon plans for the dam and lock, to be submitted to the Secretary of War; and two plans were completed, dated Dec. 1, 1903, to be sent with the application for approval. Later, when borings had progressed sufficiently so that the proposed location of the lock could be shown, an additional plan was made, to file with an amended application. This plan, with one of those accompanying the original application, was forwarded with the amended application; the latter dated Dec. 1, 1903, and entitled "Plan showing proposed dredging for channels in Charles River and dredging in Broad and Lechmere canals, in accordance with chapter 465 of the Acts of the year 1903;" the former dated Jan. 5, 1904, and entitled "Plan of preliminary location of lock and draw in proposed dam to be constructed across Charles River, between





BOSTON SIDE OF BASIN, SHOWING HEREFORD STREET OVERFLOW, LOW WATER.

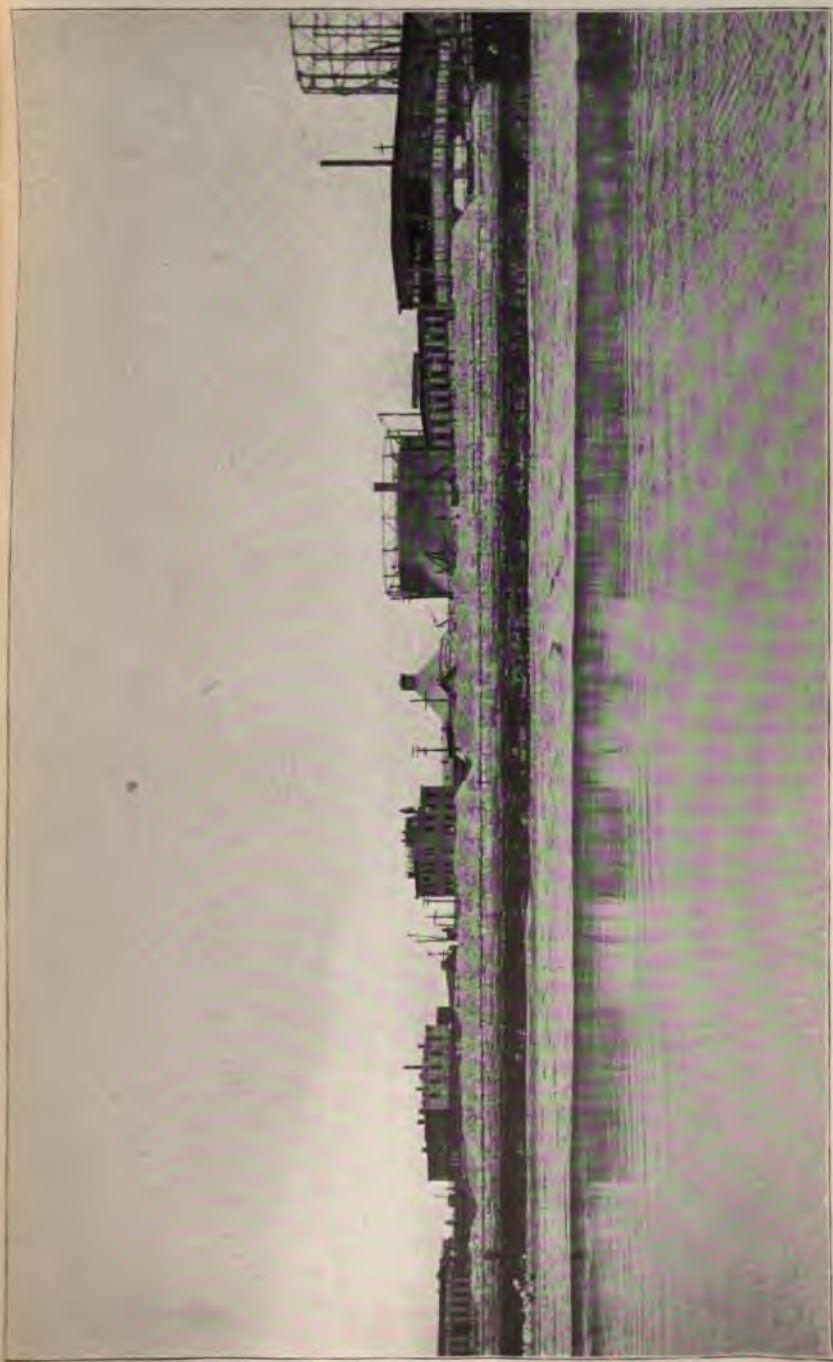




BOSTON SIDE OF BASIN BETWEEN REVERE AND PINKNEY STREETS, LOW WATER.







CAMBRIDGE SIDE OF BASIN, ABOVE CAMBRIDGE BRIDGE, LOW WATER.





CAMBRIDGE SIDE OF BASIN, SHOWING BINNEY STREET OVERFLOW.





Boston and Cambridge, and of preliminary location of draw in new bridge which may be constructed by Boston & Maine Railroad, in accordance with chapter 465, Acts of 1903." Both plans were general in character, and showed only the outline of the proposed work.

The approval of these plans by the Secretary of War, dated May 18, 1904, contained the reservation: "That detailed plans for the lock and dam, and of all channels to be dredged outside established harbor lines, shall be submitted to the Secretary of War, and that the work be not begun until such plans have received his approval."

Work on the detail plans was carried on as rapidly as it was possible to determine the general features and design the various details of construction. Two plans, dated Sept. 2, 1904, were forwarded to the Secretary of War on September 6, with the application for approval. One plan was entitled "Plan of dam and lock;" the other, "Plan showing dredging to be done in Charles River between harbor lines in connection with the construction of the dam and lock."

#### *Grade of Dam.*

The grade of the dam has been placed at about 21 feet above Boston city base.

Studies were made of the relative advantages and disadvantages of a high and low grade dam. Considerable attention was given to records of present and past traffic through the draw of Craigie bridge, showing the number of vessels that would and would not require the opening of the draw in a high-grade dam, and to records of traffic over Craigie, Warren and Charlestown bridges, to determine the effect of a high-grade bridge upon teaming.

It was decided that the dam should be at a grade satisfactory for heavy teaming, with approaches that would not make it necessary to reduce the size of loads which could be transported on the practically level streets in that vicinity; and that the amount of time lost by openings of the draw for tugs and mastless vessels could be more than compensated for by increasing the width of the highway over that at present existing, particularly at the drawbridge.

*Park.*

Studies and estimates of cost were made for various types of dams, from a structure little wider than needed for the highway to one having a park area of several acres. A design for a dam with a park on the up-stream side of the highway has been adopted, which will involve little increased cost over the designs for a narrow dam, as it will reduce materially the amount of masonry in retaining walls on the basin side of the dam, by lessening their height. It provides, in addition to the highway, a park area of nearly 7 acres, which is about two-thirds the size of the present Charlesbank. An estimate shows that the additional cost of the park will be about one-eighth of the value of an equal amount of adjacent land in Boston, or about one-fourth of the value of such land in Cambridge.

*Highway.*

The highway over the dam is to be 85 feet wide, consisting of two sidewalks each 10 feet wide and a 65-foot roadway, giving ample width for a double street car track. This width of highway was determined after a study of traffic at this point compared with that over other bridges throughout the city, and of highways and bridges subject to heavy traffic in other large cities.

Preliminary consideration was given to the questions of both temporary and permanent pavement on the completed structure.

*Shut-off Dam.*

The design of this structure and the study of various conditions likely to arise during its construction were given much attention. Several types of structures were considered, and studies were made for protection from high velocities during construction.

*Lock.*

All studies were at first made on the basis of the minimum dimensions for the lock prescribed by the act (length 350 feet between gates, width 40 feet, depth 13 feet below Boston base). Designs and studies for a lock of these dimensions were advanced toward completion when it was decided to enlarge the dimensions of the lock by making it 5 feet wider and 3.4 feet



CRAIGIE BRIDGE, FROM THE "FRONT," CAMBRIDGE.







deeper than the minimum requirements of the act. This change required additional work in designing and in analyzing the pressures to determine the proper sections of the masonry.

It seemed desirable, on account of the large amount of teaming over the bridge, to have the lock entirely above the draw-bridge, in order that travel might not be interrupted for the length of time required to fill the lock and open the gates.

The time necessary to fill the lock when locking vessels was carefully studied, and the filling gates and the method of operating them designed so as not to cause unnecessary disturbance during the passage of vessels. The question of time necessary for vessels of various sizes to pass through the lock was calculated for different elevations of the tide. Warping machinery for facilitating the passage of vessels through the lock was investigated in a preliminary manner.

The style of lock gates and method of filling required much attention, and considerable information was obtained concerning certain European lock gates, notably those at Bremerhaven, Kiel, Bruges and D'O-Becse.

Ice gates for running ice through the dam were designed in connection with the lock.

Preliminary consideration was given to the question of superstructures over the lock gate recesses, and the piers at the ends of the lock in the basin and harbor were located, and studies made of method of construction. Studies were made of methods by which the ends of the lock can be bulkheaded and the lock pumped out, should it become necessary, and proper means designed.

In connection with studies for the lock, an inspection was made of the construction and method of operation of the Welland canal.

#### *Sluices.*

The first problem in connection with the sluices was to determine the area of sluice necessary, and the economic elevation of the bottom. It was found that the flow of the river for the greatest flood of at least seventy-five years occurred in February, 1886; careful studies were made of the records of that time, and an estimate was made of the upland flow at Craigie bridge after the completion of the basin, during a flood of the same magnitude.

While the probability of a maximum flood occurring in conjunction with a succession of high spring tides is not great, sufficient sluice area has been provided to take care of a flood some 10 per cent. greater than the flood of 1886, in conjunction with continuous spring tides of a height which is exceeded but eight times in an average year. In this case there would be a rise of the water in the basin of 3 feet above the normal, and with the same rise in the basin the quantity of water that can be passed would be about 21 per cent. more than the flood of 1886 against normal tides, and about 35 per cent. more than the flood of 1886 against neap tides. Floods greater than this would not endanger the structure at the dam.

It was considered desirable to provide for the passage of small pleasure boats and similar craft through the dam without recourse to the lock, and the central sluice has been so designed as to enable it to be used for that purpose.

Preliminary designs were made of sluice gates, tide gates, and for the central sluice to be used as a small lock.

#### *Coffer-dams.*

Much time and study was given to the design of coffer-dams, within which the lock and sluices are to be built. Test pits were dug in land of George O. Proctor on the south side of Bridge Street, and in land of the Boston & Maine Railroad on the north side of Bridge Street, to determine the class of material into which the ends of the coffer-dam around the sluices would penetrate.

#### *Power.*

The question of providing power for operating the lock, sluices and drawbridge was investigated. Dependence on water power is rendered very uncertain by the dry-weather flow of the river, the small fall at the dam, and the fact that this fall varies with the elevation of the tide. The expense of installation and operation, also, would be so great as to make any such development inadvisable. The fact that the amount of power required will be very changeable, being probably greatest in the summer, when the draw and lock will be used most, and varying during the day from nothing to a maximum, renders uneconomical any plan for developing power by steam. Studies and investigations along these lines led to the conclu-



sion that it would be cheaper and more satisfactory to purchase power from one of the electric companies.

As the act provides that the lock shall be kept sufficiently free from ice to permit navigation at all times, preliminary studies were made for a heating plant, to prevent the formation of ice on the large lock gates, to provide heat for the gate-houses and other structures, and for insuring the operation of the sluice gates.

#### *Electric Conduits.*

Craigie bridge is crossed at present by the wires of three corporations. In the new structure it was considered desirable to place these wires in permanent conduits, and also to provide for the possible need of increased facilities in the future. The conduits decided upon in crossing under the lock and over the sluices, at which points they form a part of the masonry construction, are being incorporated into the contract plans for the dam and lock.

#### *Material for Embankments at Dam.*

Twenty-three borings, having a total depth of 582.2 feet, were made between July 30 and Sept. 19, 1904, in the basin, between the West Boston bridge and Harvard bridge, to ascertain the amount of selected material that can be obtained by dredging for use in the embankments at the dam.

Estimates were made of the probability of being able to obtain a part of the filling required to build the dam from various building operations in Boston and Cambridge, where excavated material would have to be wasted. The possibility of using ashes for filling at the dam was also considered.

#### *Borings.*

The borings begun at the site of the dam and lock during the previous year were continued until Jan. 16, 1904, 42 borings being made; between March 21 and April 2, 1904, 7 additional borings were made; and after the location of the upper retaining wall and other features of the dam had been substantially decided upon, 13 more borings were made, between Aug. 9 and Sept. 2, 1904; making the total number of borings for the year 62, having a total depth of 2,463.3 feet. This, added

to the boring made the previous year, having a depth of 56.3 feet, makes a total of 63 borings made at the site of the dam and lock, with a total depth of 2,519.6 feet.

### *Test Piles.*

Arrangements were made with the firm of Holbrook, Cabot & Rollins, of Boston, for driving a number of test piles at the site of the dam, to determine the penetration required for foundation piles. A study was made of the data furnished, which has to a considerable extent formed the basis of the engineer's estimate of foundation piles required, in the contract for the dam and lock.

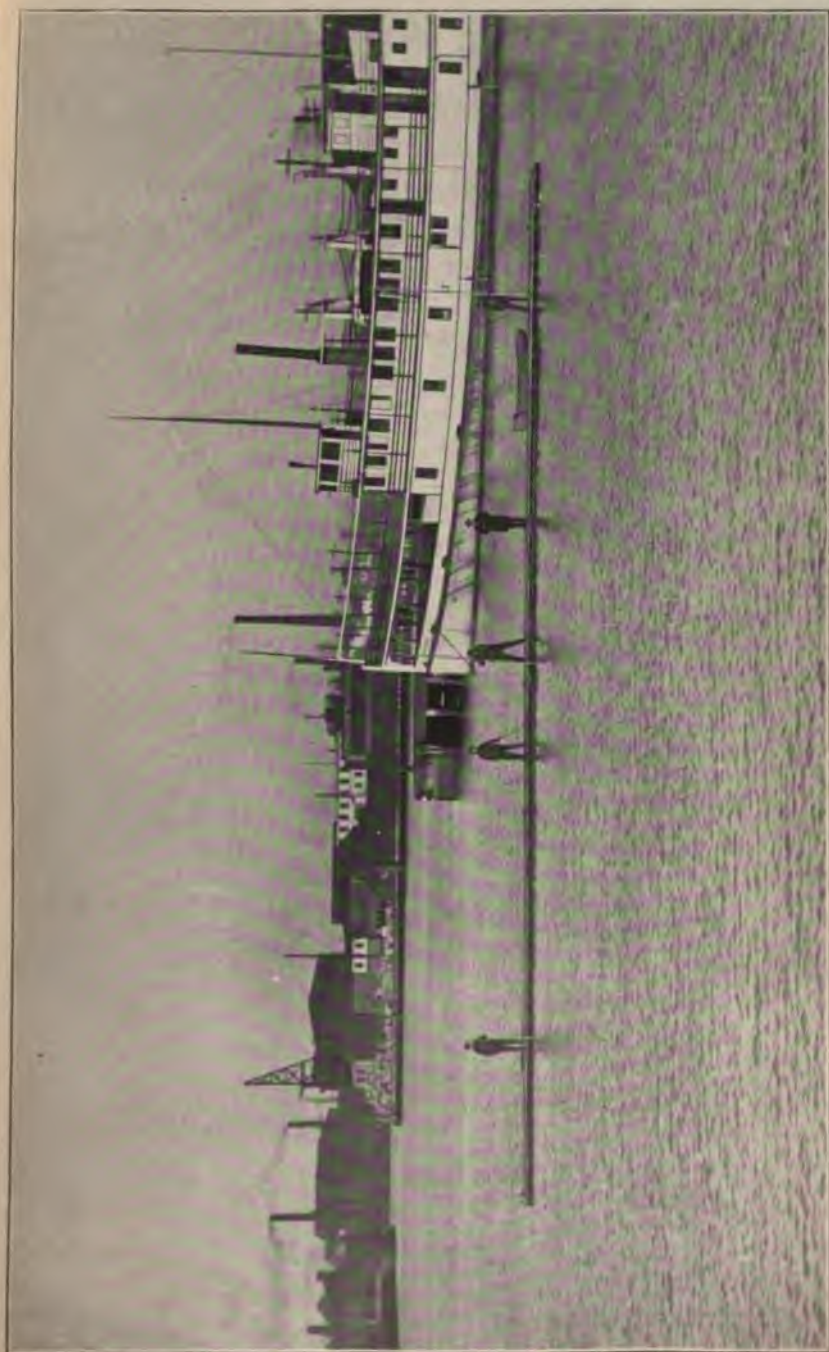
### *Soundings.*

The work of taking soundings was begun September 23. It was decided that soundings 25 feet apart would be sufficiently close to give accurate results when figuring quantities of embankments, and to enable a close watch to be kept, after the beginning of construction of the shut-off dam, to detect any washing or scouring by the increased velocity of the current, due to the decrease in sectional area.

The area to include the dam and lock was covered by a system of rectangular co-ordinates, having its origin in a line parallel with and 500 feet easterly from the centre line of the proposed lock, and in a line parallel with and 500 feet northerly from the centre of the railing on the northerly side of the roadway of the proposed dam.

A raft, 103 feet long by 3 feet wide, was built, with one side marked every 5 feet from 0 to 100, and the other side, beginning at the same end, marked from 100 to 0. The raft was provided with mooring rings, cleats and six 30-pound anchors. Two pairs of anchors were connected with each other by about 500 feet of light wire rope, and to each of the other anchors was fastened about 500 feet of light Manila rope. One pair of anchors was placed at one end of the raft, with one anchor on each side of the raft and about 200 feet away from it, and a turn was taken around a cleat at the end of the raft with the wire rope connecting the two anchors; the other pair of anchors was fastened in a similar manner at the opposite end of the raft. One of the anchors, with the 500 feet of Manila rope,





SOUNDING RAFT.



was dropped up stream, and the other anchor was dropped down stream, from each end of the raft.

Ranges were erected on Craigie bridge, on the Boston & Maine Railroad freight bridge and on the Boston and Cambridge shores of the basin. The raft then being placed approximately parallel with the current, one side of it was brought into line with the ranges on Craigie bridge and on the freight bridge, and the point marked 0 on the raft was brought into line with the ranges on the Boston or Cambridge shore, at right angles with the side of the raft. Soundings were then taken along the side of the raft at the 0, 25, 50, 75 and 100 foot points. Upon completion of these soundings, by pulling on the wire ropes connecting with each pair of anchors at the ends of the raft, and slacking or hauling on the bow and stern lines, the raft was moved 25 feet across the current, the side brought into line with the next set of ranges with the 0 mark on line with the range at right angles to the raft, and another set of soundings taken.

Three sounding rods were used, 15 feet, 26 feet and 36 feet long, respectively. The 15-foot rod was made of pine, dressed to  $1\frac{1}{8}$  inches thick, tapered from a width of 3 inches at the base to  $1\frac{3}{4}$  inches at the top, graduated into tenths, and was used in the shallow portions of the river without a weight. The other two rods were made of cypress, circular in shape, tapering from a diameter of 3 inches at the base to  $1\frac{3}{4}$  inches at the top, and graduated at each  $\frac{2.5}{100}$  of a foot. At the bottom of these two rods an iron casting was used to overcome the buoyancy. This casting, which was made of a cylinder 3 inches inside diameter and 8 inches high, on top of a plate 1 inch thick and 8 inches in diameter, with six  $\frac{3}{4}$ -inch holes bored through it, was fitted over the end of the rod, and bolted through it with a  $\frac{3}{8}$ -inch bolt. The casting weighed 21 pounds. Six cast-iron rings,  $\frac{1}{2}$  inch thick and 3 inches in diameter, were also made to be slipped over the end of the rod, so that the weight could be increased when used in deeper water. A ring was fastened to the casting, and, by means of a rope passed through the ring, assistance was given to the man taking soundings, by pulling on this rope when moving the rod against the current. The rod was not removed from the water while taking one set of



soundings the length of the raft. As stated above, the taking of soundings was commenced but a short time before the end of the year covered by this report, and the area covered by soundings was  $2\frac{1}{2}$  acres.

*First Contract.*

It was considered advisable, almost from the beginning, to include the main portion of the work of constructing the dam and lock in one contract; and plans were laid out with the view of beginning construction at the earliest possible date. As the work involved the design of most of the features of the lock and lock gates, sluices, outlets of marginal conduits, and highway, with arrangements for dredging in the canals and basin, it became necessary to determine all these features with a fair degree of accuracy prior to drawing the contract plans.

The plans for this contract were first drawn on the basis of a lock of the minimum dimensions required by the act. When it was concluded to change the dimensions of the lock, it was necessary to modify the designs to such an extent as to very largely destroy the usefulness of the previous drawings.

A set of 19 sheets, 26 inches by 40 inches, which are to be lithographed to half size, was nearly completed at the close of the year. They cover the principal work necessary to build the dam and lock, and to do the dredging required by the act, in the basin and in the Broad and Lechmere canals.

The contract will not include various appurtenances, such as lock gates, sluice gates, tide gates, power plant, heating plant, drawbridge, loam and gravel for surfacing the park area, street surfacing, fencing, miscellaneous iron and other metal work, warping machinery, and outlets for marginal conduits, which will be contracted for and installed as the progress of the main contract permits.

*DRAWBRIDGE.*

Studies which have been made for the draw over the lock indicate that some form of bascule or rolling lift bridge will best satisfy the conditions at this point. The foundation, which forms a continuation of the side wall of the lock, has been designed for a bridge of this kind, and can be modified as desired when the final type of structure is adopted. The width of the drawbridge is to be 85 feet.



## TEMPORARY BRIDGE.

Very careful studies were made of the possibility of maintaining traffic over Craigie bridge, and of the handling of river traffic, during the construction of the dam; but it was regarded as impracticable to maintain traffic over coffer-dams of such magnitude as will be required. A count was made of the number of pedestrians, teams and street cars passing Craigie bridge for each day in the week, from 6 A.M. to 7 P.M., and for one night from 7 P.M. to 6 A.M.; a similar count was made for two days on Warren and Charlestown bridges. The results are shown in Table No. 1:—

TABLE No. 1.

LOCATION.	Date.	Teams.	Pedestrians.	Surface Cars.	Elevated Cars.	
Craigie bridge, .	Tues., Nov. 10, 1903, .	3,941	5,082	828	-	From 6 A.M. to 7 P.M.
	Wed., " 11, " .	4,030	5,137	837	-	
	Thurs., " 12, " .	4,115	4,924	801	-	
	Fri., " 13, " .	4,389	4,933	801	-	
	Sat., " 14, " .	3,553	6,062	809	-	
	Mon., " 23, " .	4,190	5,177	785	-	
Average per day, .	. . . . .	4,037	5,219	810	-	
Craigie bridge, .	Wed., March 9, 1904, .	144	1,543	303	-	From 7 P.M. to 6 A.M.
Warren bridge, .	Tues., Nov. 24, 1903, .	5,746	6,816	263	-	From 6 A.M. to 7 P.M.
	Wed., " 25, " .	5,795	6,711	217	-	
Average per day, .	. . . . .	5,771	6,764	240	-	
Charlestown bridge.	Thurs., Nov. 19, 1903, .	4,027	9,628	1,457	2,085	From 6 A.M. to 7 P.M.
	Fri., " 20, " .	4,173	9,937	1,488	2,158	
Average per day, .	. . . . .	4,100	9,783	1,472	2,121	

Studies were also made, and cost estimated, of methods of taking care of street traffic on several proposed locations for a temporary bridge.

Auger holes were bored in piles and stringers of the freight

bridge of the Boston & Maine Railroad, to determine the condition of timbers with reference to the use of the bridge as a temporary highway bridge. It seemed best to utilize this bridge for the main portion of the temporary highway bridge, as soon as the railroad should have built its new bridge. A new draw and a new bridge east of the draw will be required. This method furnishes a satisfactory and economical solution of the problem, and will take all street traffic out of the way of the contractor for the dam and lock.

Five borings, having a total depth of 178.5 feet, were made at the site of the new work, between Aug. 12 and Aug. 24, 1904.

A plan, dated Aug. 11, 1904, was prepared, to be forwarded with the application to the Secretary of War for approval of the use of this bridge, entitled "Plan showing temporary highway bridge, to be built mainly on present Boston & Maine Railroad bridge over Charles River between harbor lines, for use during construction of dam and lock."

#### BOSTON MARGINAL CONDUIT.

The first studies necessary were for the purpose of determining the size of the conduit and the elevation of the invert. These were dependent upon many conditions which had not been determined, such as the future separation of sewage from storm water; the ability of the increased pumping plant of the city of Boston and of the new pumping plant of the high-level metropolitan system to reduce future overflows into the basin; the effect of street wash alone (in the event of the entire separation of sewage from storm water) on the water of the basin; and the ability of the fresh water in the basin to take more organic pollution, without serious sanitary objection, than the present salt water.

Many calculations were made of the capacity of conduits of various sizes laid at or below Boston city base, and the cost estimated.

The run-off of Stony Brook was studied, particularly for the months of June, July, August and September, during which time the use of the basin as a water park would be greatest. Accurate gagings made in 1897 of the flow from about .8 of the area tributary to the marginal conduit above the dam were



used as a basis for determining the future flow at the dam, and a comparison of the rainfall of that year with the normal rainfall made it possible to obtain a very fair idea of the run-off to be expected during an average season. The records of the automatic rain gage at Chestnut Hill were valuable in giving the relation between showers in 1897 and those of an average year, and in determining the conditions under which such showers might overflow from conduits of various capacities into the basin.

Data were obtained regarding the elevations, sizes and watersheds of the various sewers, in both Boston and Cambridge, discharging through overflows into the Charles River; and many inspections were made, after storms, of the character of the discharge.

The question of the amount of pollution from the sewer overflows on the Boston side of the river is one upon which there has been considerable difference of opinion. Most of the estimates of quantities discharged by sewer overflows have been based upon records of the clock gage on the Binney Street regulator, maintained by the city of Cambridge, and of the recording gage of the metropolitan sewer in Huntington Avenue, near Gainsborough Street. In order to obtain additional data, recording gages were placed in the manhole of the 7-foot sewer of the town of Brookline, at the junction of St. Mary's Street and Commonwealth Avenue; and in the manhole of the sewer of the city of Boston, at the junction of Hereford and Beacon streets, as these two overflows were believed to discharge the largest quantities. Gages were also connected with the tide gates at both St. Mary's and Hereford streets, for the purpose of obtaining the length of time that the discharge is taking place. The gages at Hereford Street were started on February 24, and those at St. Mary's Street on March 3, all of which have since been operated continuously. After they had been in operation two months, gages were placed on the remainder of the most active overflows on the Boston side of the river, between Hereford Street and Craigie bridge; and soon after May 1, recording gages were in operation at the overflows in Beacon Street, at Fairfield, Dartmouth, Berkeley and Beaver streets, and at the junction of Brimmer and Back streets. While the sewage overflow at some points

was considerable, it is expected that it will be very materially reduced by the completion of the metropolitan high-level sewer and the operation of the pumps at Ward Street, with the additional pump which is being installed at the Boston main drainage pumping station.

Designs were made, and incorporated in the contract drawings for the dam and lock, of the portion of the marginal conduit that comes inside the embankment of the dam. These include designs of the outlet chamber and tide gates, with provision for discharging the ordinary storms through two lines of 60-inch cast-iron pipe leading to deep water below the dam; and designs of connections with the basin, making possible the use of this portion of the conduit for the purpose of discharging the flood flows from the river.

Some preliminary consideration was given to the question of connecting with the marginal conduit the overflow sewers leading into the basin between the dam and the Fens, to the design of a gate-house at the Fens, and to investigations of the method and cost of providing circulation in the Fens.

A plan was made showing the proposed location for the conduit in the Charlesbank between Cambridge and Leverett streets.

A survey was made to locate the trees in the Charlesbank in the vicinity of the proposed location of the marginal conduit. Each tree 4 inches or more in diameter was located by means of an angle and stadia distance, and the approximate spread of the branches determined. A plan was made showing the outlines of the shrubbery, and the location, kind, size and spread of every tree, with the location of the old sea walls.

The location of the old shore line and the outlines of the old sea walls, piers and docks within the limits of the Charlesbank were obtained from plans in the office of the survey division of the city of Boston, one dated 1854, and one showing the successive shore lines since 1795.

#### CAMBRIDGE MARGINAL CONDUIT.

This conduit has been designed from a point on the southerly side of Lechmere canal to its outlet below the dam. It is expected that the conduit will be built through the East Cam-





BROAD CANAL ABOVE RAILROAD BRIDGE, LOW WATER.



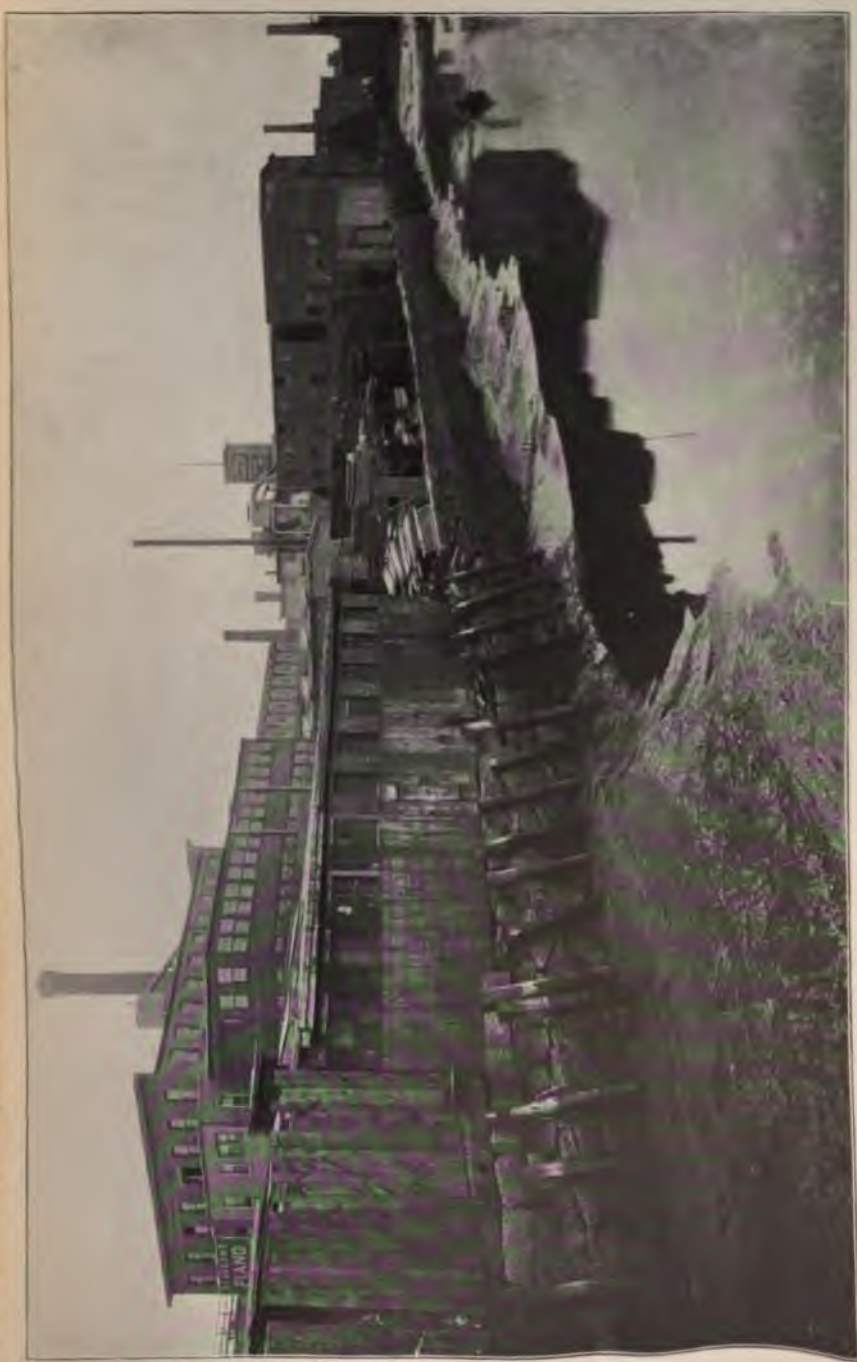


NORTH SIDE BROAD CANAL, BELOW RAILROAD BRIDGE, LOW WATER.



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SOUTH SIDE BROAD CANAL, ABOVE SIXTH STREET, LOW WATER.





NORTH SIDE BROAD CANAL, AT THIRD STREET, ABOUT LOW WATER.







WEST BANK LECHMERE CANAL, LOW WATER.

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bridge embankment to a point near the intersection of the Lechmere canal and the harbor line, from which point it will be a submerged 60-inch cast-iron pipe, at an elevation sufficiently low to provide for navigation, connecting with the masonry of the sluices at the basin side of the dam. It will extend through the dam as a masonry conduit, connecting at its lower end with the Bridge Street sewer, and having overflow outlets into the most westerly of the sluices. The ordinary flows in this conduit will unite at its lower end with the ordinary flows from the Bridge Street sewer, and will discharge through a single line of submerged 60-inch pipe, extending into deep water on the north side of the dam. When the combined flow of the marginal conduit and the Bridge Street sewer is in excess of the capacity of the 60-inch outfall pipe, the excess will discharge through the outlets previously mentioned into the most westerly sluice.

#### DREDGING IN THE BASIN AND IN THE BROAD AND LECHMERE CANALS.

The Commission is required, by section 4 of chapter 465 of the Acts of 1903, to dredge navigable channels in the basin, and to deepen the Broad and Lechmere canals by dredging. The work as planned will be somewhat in excess of the minimum requirements of the act, as all material in the basin is to be dredged to elevation —10, Boston city base, and in front of the lock the material is to be dredged to elevation —13, Boston city base. This will permit vessels drawing nearly 21 feet of water to enter the basin.

Fifty-nine borings were made in the basin and in the canals, to determine the character of the material to be removed. The borings had an aggregate depth of 1,255 feet, and were made between April 5 and May 6, 1904.

Descriptions were written and plans made showing the frontage of the different property owners along the basin and on the canals, for the purpose of securing releases from the abutters to the Commonwealth of any damage that might be done by dredging to the required depth, after having driven prime oak piles 2 feet on centres, as provided in the act.

In connection with the location of ranges for soundings across

Broad canal, placed every 25 feet, measurements were taken of the actual location of the walls at these points.

Plans were prepared and an estimate made of the cost of lowering the siphons under Broad canal. It was found to be unnecessary to change the location of the sewer siphon in Commercial Avenue under Lechmere canal, as it is just below the elevation specified for dredging, and a proposed method for protecting it has been approved by the city engineer of Cambridge.

#### SUMMARY OF BORINGS.

The following is a summary of borings in the basin and canals : —

	Number of Borings.	Total Depth (Feet).
Made during the year, . . . . .	149	4,479.0
Made previous to Oct. 1, 1903, . . . . .	1	56.3
Total, . . . . .	150	4,535.3

All borings were made by Gow & Palmer of Boston ; those in the Broad and Lechmere canals, and along the Cambridge side of the basin between the canals, for 50 cents per linear foot, under contract dated April 5, 1904. All other borings were made by the same firm, at cost and 15 per cent. for the labor, with an allowance for rent of the boring outfit.

The method of making these borings was described in the report of the chief engineer for the year ending Sept. 30, 1903.

Plans and sections, showing the results of the borings, were incorporated in the contract drawings for the dam and lock. Six hundred and thirty samples obtained from the borings were labelled and filed in the vault of the Commission.

#### UPLAND FLOW OF THE CHARLES RIVER.

Available data relative to flows of the Charles River were examined, and considerable attention was given to measurements of the flow of the river.

Unusual opportunities were afforded for the measurement both flood and dry-weather flows. A very heavy rainfall

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 to the following points:

1900.	Inches	1900		
June, . . .	1.41	July,		
July, . . .	2.80	August,		
August, . . .	1.28	September,		
Total for three months,	5.49	Total for three months,		

1900.	Inches	1900		
June,	1.41	July,		
July,	2.80	August,		
August,	1.28	September,		
Total for three months,	5.49	Total for three months,		



Table No. 2 shows the estimated average flow of the Charles River at Waltham for weekly periods during the year ending Sept. 30, 1904. Prior to the week ending July 16, 1904, the flows given in the table are the results of calculations made from records kept by the Boston Manufacturing Company at Moody Street, Waltham. They are deduced from the horse-powers of the water wheels in use, added to the quantity wasted over the flash-boards. The area of the watershed above Moody Street is assumed to be 157 square miles, except during the months of March, April and May, when it is assumed to be 181 square miles, owing to the overflow from the Stony Brook watershed of the Cambridge water supply. Since the week ending July 9 the flow has been measured at the dam of the Waltham Bleachery, and the area of the watershed above this dam is assumed to be 169 square miles.

Table No. 3 shows the number of days from October, 1903, to September, 1904, inclusive, when the flow of the Charles River at Craigie bridge, estimated from records kept by the Boston Manufacturing Company at Moody Street, and by the Charles River Basin Commission at "The Bleachery," Waltham, was more than 500 cubic feet per second per twenty-four hours.

Table No. 4 shows the length of time during which a normal tide will be above the water in the basin, and the rise of the basin during that interval for various rates of upland flow.

TABLE No. 2.—*Estimated Weekly Average Flow of Charles River at Waltham for the Year ending Sept. 30, 1904.*

WEEK ENDING—	Cubic Feet per Second.	Cubic Feet per Second per Square Mile.	WEEK ENDING—	Cubic Feet per Second.	Cubic Feet per Second per Square Mile.
<b>1903.</b>			<b>1904.</b>		
Oct. 10, . . .	24	.15	April 9, . . .	638	3.52
17, . . .	99	.63	16, . . .	576	3.18
24, . . .	141	.90	23, . . .	502	2.78
31, . . .	59	.38	30, . . .	584	3.32
Nov. 7, . . .	24	.15	May 7, . . .	1,267	7.00
14, . . .	64	.41	14, . . .	430	2.38
21, . . .	24	.15	21, . . .	286	1.58
28, . . .	48	.31	28, . . .	226	1.25
Dec. 5, . . .	24	.15	June 4, . . .	195	1.24
12, . . .	17	.11	11, . . .	178	1.13
19, . . .	98	.62	18, . . .	82	.52
26, . . .	111	.71	25, . . .	76	.46
<b>1904.</b>			July 2, . . .	49	.31
Jan. 2, . . .	109	.70	9, . . .	33	.21
9, . . .	24	.15	16, . . .	71	.42
16, . . .	47	.30	23, . . .	113	.67
23, . . .	72	.46	30, . . .	55	.33
30, . . .	87	.55	Aug. 6, . . .	58	.34
Feb. 6, . . .	85	.54	13, . . .	58	.34
13, . . .	87	.55	20, . . .	45	.27
20, . . .	87	.55	27, . . .	37	.23
27, . . .	158	1.00	Sept. 3, . . .	31	.18
March 5, . . .	239	1.32	10, . . .	29	.17
12, . . .	550	3.04	17, . . .	92	.54
19, . . .	655	3.62	24, . . .	232	1.37
26, . . .	665	3.67	Oct. 1, . . .	119	.70
April 2, . . .	789	4.36			

One hundred and fifty-seven square miles of watershed area from Oct. 10, 1903, to Feb. 27, 1904, and from June 4 to July 9, 1904, inclusive.

One hundred and eighty-one square miles of watershed area from March 5, 1904, to May 28, 1904, inclusive.

One hundred and sixty-nine square miles of watershed area from July 16, 1904, to Oct. 1, 1904, inclusive.

TABLE NO. 3. — *Number of Days from October, 1903, to September, 1904, inclusive, when Estimated Flow of Charles River at Craigie Bridge was More than 500 Cubic Feet per Second for Twenty-four Hours, from Records kept by Boston Manufacturing Company at Moody Street, and by the Charles River Basin Commission at "The Bleachery," Waltham.*

MONTH.	500-750 Cubic Feet per Second (Days).	750-1,000 Cubic Feet per Second (Days).	1,000-1,500 Cubic Feet per Second (Days).	1,500-2,000 Cubic Feet per Second (Days).	Over 2,000 Cubic Feet per Second (Days).	Total Number of Days exceeding 500 Cubic Feet per Second.	Rainfall at Chestnut Hill (Inches).	Average Rainfall on Sudbury Watershed for Twenty-nine Years (Inches).
<b>1903.</b>								
October, . . . .	-	-	-	-	-	-	4.87	4.31
November, . . . .	-	-	-	-	-	-	1.53	4.03
December, . . . .	-	-	-	-	-	-	3.01	3.85
<b>1904.</b>								
January, . . . .	-	-	-	-	-	-	5.64	4.18
February, . . . .	1	-	-	-	-	1	2.90	4.39
March, . . . .	6	10	8	-	-	24	2.85	4.06
April, . . . .	18	7	4	-	-	29	9.18	3.43
May, . . . .	4	1	1	5	1	12	3.28	3.37
June, . . . .	-	-	-	-	-	-	2.75	3.10
July, . . . .	-	-	-	-	-	-	1.48	3.73
August, . . . .	-	-	-	-	-	-	2.74	4.06
September, . . . .	-	-	-	-	-	-	5.75	3.23
Totals, . . . .	29	18	13	5	1	66	45.98	46.34

TABLE NO. 4. — *Time during which a Normal Tide will be above the Water in the Basin, and Rise of Basin during that Interval for Various Rates of Upland Flow.*

Rate of Upland Flow (Cubic Feet per Second).	Time Harbor will be above Basin.		Rise of Basin (Feet).	Rate of Upland Flow (Cubic Feet per Second).	Time Harbor will be above Basin.		Rise of Basin (Feet).
	Hours.	Minutes.			Hours.	Minutes.	
500	3	48	.20	3,000	3	19	1.02
1,000	3	42	.39	4,000	3	8	1.28
1,500	3	36	.56	5,000	2	58	1.51
2,000	3	30	.72	6,000	2	49	1.71
2,500	3	25	.87				



*Measurements of Maximum Flow in Charles River.*

Preparations for measuring the maximum flow in the river during the spring of 1904 were made by setting gage boards on the up-stream and down-stream faces of the Ames Street bridge over the Charles River and of the Centre Street bridge over Mother Brook in Dedham; and by setting a gage board above the Moody Street bridge, with one at the outlet of the tail-race from the plant of the Boston Manufacturing Company at Waltham. A Fteley & Stearns current meter was also obtained and rated by the hydrographic branch of the United States geological survey. Soundings were made through the ice to obtain a cross-section of the bed of the river at the Ames Street bridge, and of the bed of Mother Brook at the Centre Street bridge.

From 9 A.M. on April 27 to 11 A.M. on April 29, over 5 inches of rain fell, varying from 5.17 inches at the Weather Bureau to 5.20 inches at Chestnut Hill and 5.57 inches at the Cambridge City Hall. This rainfall has been exceeded in amount, for the same or a shorter period of time, only twice since Jan. 1, 1882.

Current meter measurements were taken of the flow of the Charles River at Ames Street, of Mother Brook at Centre Street, of Long Ditch at Needham Street, and of Wigwam Brook at Washington Street. These measurements showed a maximum flow of about 2,130 cubic feet per second on May 2 in the Charles River above Mother Brook, or at the rate of 10.8 cubic feet per second per square mile of watershed. At the same time the amount flowing in Mother Brook was found to be about 558 cubic feet per second, which is about 26.2 per cent. of the total flow of the river at that point.

At the Waltham dam the measurement showed a flow of 1,363 cubic feet per second per twenty-four hours on May 3. During the same time the water above the Waltham dam rose at the rate of .4 foot in twenty-four hours. This rate of increase in the storage between Waltham and Newton Lower Falls is equal to a flow of about 93 cubic feet per second, which, added to 1,363, makes 1,456 cubic feet per second, the yield of the river at Waltham, or about 8 cubic feet per second per square



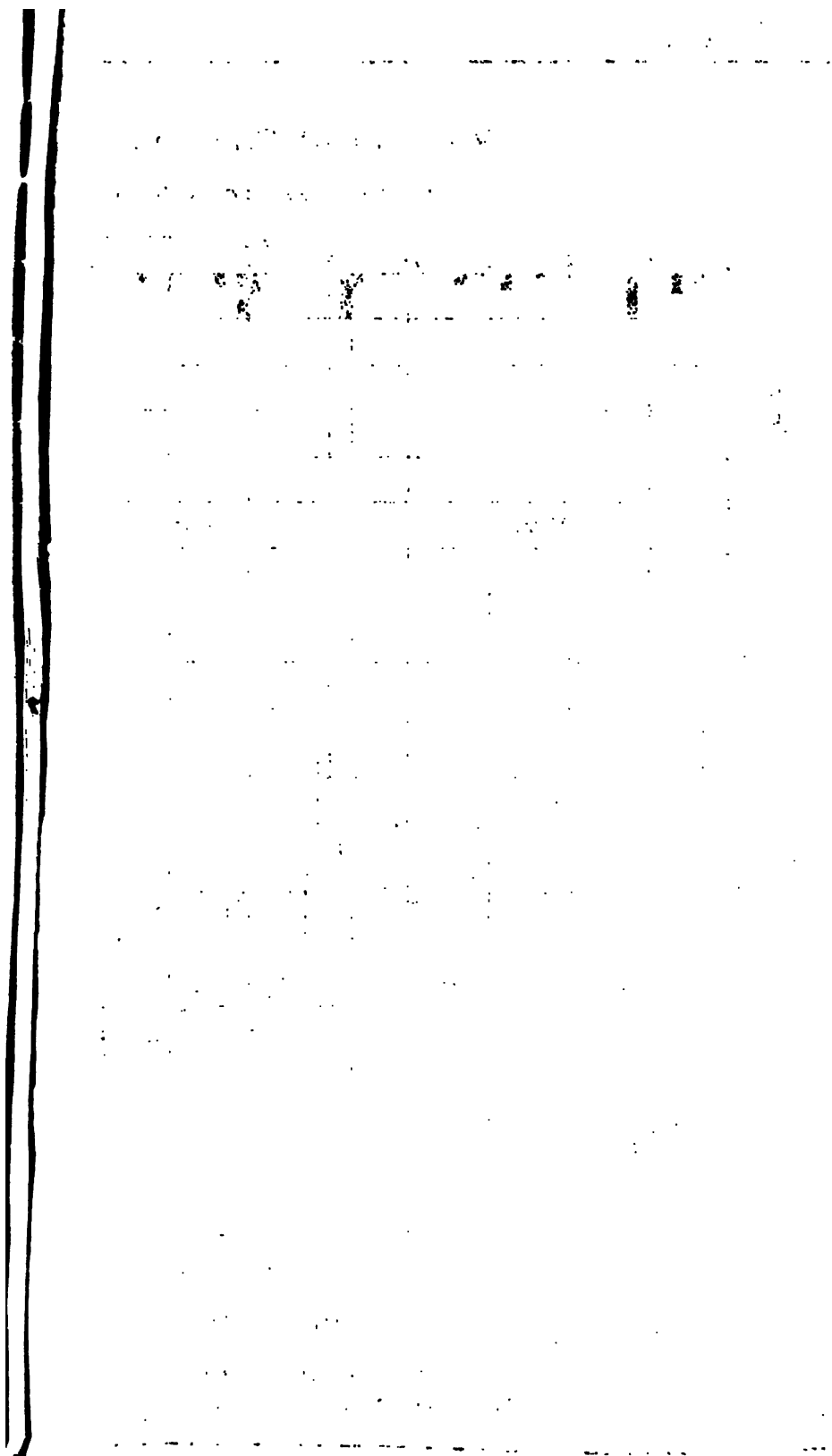
mile of watershed. Assuming that the run-off from the watershed between Waltham and Craigie bridge was at the same rate would give a flow at Craigie bridge of about 1,912 cubic feet per second. The maximum flow at Waltham, however, appears to have been on May 2 when the party was occupied in measuring the flow at Dedham; and the estimated flow at Craigie bridge, using the records of the Boston Manufacturing Company for May 2, would have given a flow of a trifle over 2,000 cubic feet per second at Craigie bridge as the run-off on that day.

Diagram No. 1 shows the estimated daily average spring flow of the Charles River at Moody Street, Waltham, and the amount of rainfall at Chestnut Hill for the spring months. It is interesting to note that the crest of the flood caused by the large rainfall of April 27 and 28 did not reach Waltham until May 2.

*Measurements of Minimum Flow in Charles River.*

Examinations were made of the dams across the river at Watertown, Bemis, Waltham Bleachery and the Boston Manufacturing Company, to determine which location presented the most favorable conditions for more accurately measuring the dry-weather flow of the river. The dam of the Waltham Bleachery and Dye Works was selected as the best place, and a recording gage to show the depth of water flowing over the crest was put in operation at that place on July 8. No water is used at this point for developing power, but water is taken from a canal about 11 feet wide, for washing purposes. The flow is quite uniform, however, and measurements were taken with a current meter to determine the average amount flowing through the canal. The dam is about 189 feet long. It has a stone crest about 16 inches high, with a 5-inch timber on top, and on top of that a 4-inch timber, making the fall about 2.1 feet. The up-stream side is a gradual slope of about 2 to 1, and the fall is over a sharp-cornered crest, 4 inches wide.

As the flow of the stream diminished during the summer, it was decided to contract the length of the overflow, in order to obtain a more accurate measurement of the minimum flow. Flash-boards about 10 inches high were put on, leaving a space 30 feet wide near the centre of the stream. This portion of the crest was carefully levelled with an engineer's level, and





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elevations taken 2 feet apart showed no variation of more than .005 foot in the length of the weir. The edge of the crest was sharp, and air had free access behind the falling sheet of water.

The minimum flow was observed on September 10 and 11, when the depth of water over the sharp-crested weir, 30 feet long, was .15 foot. This equals a discharge of about 5.8 cubic feet per second, and, added to 20 cubic feet per second (the amount flowing in the canal for washing purposes, as determined by current meter measurements the same days), gives a minimum flow of about 26 cubic feet per second; which, on a watershed of 169 square miles, is equal to a yield of about .15 cubic foot per second per square mile.

Diagram No. 2 shows the estimated daily average dry weather flow of the Charles River at the Waltham Bleachery, and the rainfall at Chestnut Hill for the same period.

#### TRAFFIC THROUGH DRAW OF CRAIGIE BRIDGE.

A record was kept of the traffic through the draw of Craigie bridge, giving the tonnage, draft and time of passage of vessels of different kinds. The time actually consumed by some of the typical coal barges in passing the draw was carefully observed, and the rate of starting and stopping determined. Records were also obtained from the street department of the city of Boston, showing the number of draw openings per year at Craigie bridge from 1871 to 1902, and the number of vessels passing from 1885 to 1902.

The results of the records obtained are shown by the following diagrams:—

Diagram No. 3 shows the weekly total of cargoes, in tons, passing Craigie bridge for the year ending Sept. 30, 1904.

Diagram No. 4 shows the monthly total of cargoes, in tons, passing Craigie bridge since Sept. 30, 1899. This diagram indicates a quite regular decrease in the amount of tonnage for the last five years, with the exception of the year 1900-1901, when the construction of the foundation for the piers of the new Cambridge bridge caused a large increase in the traffic at Craigie bridge.

Diagram No. 5 shows the yearly number of vessels passing Craigie bridge since Sept. 30, 1885, and the number of times

the draw was opened per year since Sept. 30, 1871, the only complete years covered by existing records.

Ice formed in the river in the latter part of December, remaining there until after the first of March. Traffic through the draws was absolutely closed, on account of ice, from January 3 to January 7. The draw of Craigie bridge was opened in February only 42 times and in January 82 times, a total of 124 openings in two months, — the smallest number of openings for two consecutive months in the last ten years.

#### MISCELLANEOUS ENGINEERING WORK.

The following is a brief statement of engineering work performed, in addition to that mentioned in connection with the above subjects : —

Surveys were made of Craigie bridge and vicinity, of the Boston & Maine Railroad freight bridge and approaches to same, and of the Broad and Lechmere canals. Bench levels were run on the Boston side of the river from Craigie bridge to the Fens, and on the Cambridge side from Craigie bridge to the new Cambridge bridge and around the ends of the Broad and Lechmere canals.

A testing station for tapes was laid out on the Charlesbank wall with a 100-foot tape that had been verified by the Bureau of Standards at Washington, D. C. Base lines were measured along the Charlesbank wall and along the wall of "The Front" on the Cambridge shore, and the distances between the triangulation points used by J. R. Freeman, chief engineer of the committee on the Charles River dam, were carefully calculated.

Although the angles of the triangulation system used by Mr. Freeman in his survey of the basin had been adjusted by the engineering force under his direction, it seemed advisable to have the location of the triangulation points used by him established on a system of rectangular coördinates referred to the true north line through the centre of the State House as a basis, which is the system adopted by the Boston Board of Survey and the Metropolitan Park Commission in their work. A survey had been made for the Boston water department of the street lines adjacent to the Charles River between Leverett Street and



Beacon Street, and coördinates referred to lines 50,000 feet south and east of the State House determined for the different points used in this survey. These points were connected with the triangulation points in the lower basin used by the party under Mr. Freeman, and the coördinates of the points called "Coleman," "Granite," "Charlesbank" and "Circular Landing" were determined. The work was done in December, with considerable variation of temperature. In making the connection between the survey points of the Boston water department in Charles Street and the triangulation points on the Charlesbank wall, the angles were repeated three times and afterwards adjusted. A Buff & Berger transit was used, reading to 30 seconds. In the triangulation across the basin three Buff & Berger instruments were operated simultaneously; angles were repeated twelve times, six direct and six reverse. Readings from both verniers were recorded, and a mean taken. A traverse was carried across the river, using Craigie bridge and the Boston & Maine Railroad freight bridge, and a connection made with the triangulation point called "Granite" on the Cambridge side of the river.

New detail topographic plans, on a scale of 40 feet to the inch, were made of the area from the Boston & Maine Railroad freight bridge to the new Cambridge bridge, including the Broad and Lechmere canals. All plan work of this character was reduced to a system of rectangular coördinates referred to the State House.

A topographic map of the drainage area above Craigie bridge was prepared, showing the limits of the watershed and the various diversions for water supply and other purposes. A capacity diagram of the proposed basin was made, for use in the various hydraulic computations connected with the flood discharge through the dam.

A large perspective view of the proposed basin was made, showing the dam and lock in the foreground.

The total number of finished plans prepared was 60, besides many diagrams and designs.

Tide records were looked up, and tabulations of spring and neap tides were prepared from the records of the metropolitan

sewerage works and from tables of predicted tides. A recording tide gage was established in the house of the drawtender at Craigie bridge on January 30, and since that date a record of the rise and fall of the tides has been kept on file in the office of the Commission.

Fifty-five photographs were taken by Mr. Luther H. Shattuck, under contract dated March 26, 1904.

Respectfully submitted,

HIRAM A. MILLER,  
*Chief Engineer.*

Boston, Dec. 20, 1904.



## APPENDIX A.

[CHAPTER 465 OF THE ACTS OF THE YEAR 1903.]

### AN ACT TO AUTHORIZE THE CONSTRUCTION OF A DAM ACROSS THE CHARLES RIVER BETWEEN THE CITIES OF BOSTON AND CAMBRIDGE.

*Be it enacted, etc., as follows :*

SECTION 1. The governor of the Commonwealth, with the advice and consent of the council, shall appoint three commissioners, residents of the metropolitan parks district, who shall constitute the Charles river basin commission, hereinafter called the commission, and who shall be sworn before entering upon the duties of their office. One commissioner shall be designated by the governor as chairman, and two commissioners shall constitute a quorum. The term of office shall be three years, and all vacancies shall be filled by the governor, with the advice and consent of the council. Any commissioner may be removed by the governor, with the advice and consent of the council, for such cause as he shall deem sufficient and shall assign in the order of removal. Each commissioner shall receive an annual salary of such amount as the governor and council shall determine.

Charles river  
basin  
commission,  
appointment,  
term, etc.

Compensation.

SECTION 2. The commission may appoint a secretary, engineers and assistants, shall keep accurate accounts of its expenditures, and shall make an annual report of its doings, including an abstract of its accounts, to the governor and council. The commission, whenever the Commonwealth has been authorized by the United States to build a dam and lock under the provisions of this act, shall proceed to do the work herein required of it, and shall in the meantime make examinations and plans therefor.

Powers and  
duties.

SECTION 3. The commission shall construct across Charles river, between the cities of Boston and Cam-

Dam to be  
constructed  
across Charles  
river, etc.

bridge, a dam, at least sufficiently high to hold back all tides and to maintain in the basin above the dam a substantially permanent water level not less than eight feet above Boston base. The dam shall occupy substantially the site of the present Craigie bridge, which shall be removed by the commission. The dam shall be not less than one hundred feet in width at said water level, and a part thereof shall be a highway and the remainder shall be a highway, or a park or parkway, as the commission shall determine. The dam shall be furnished with a lock not less than three hundred and fifty feet in length between the gates, forty feet in width and thirteen feet in depth below Boston base, and shall be built with a suitable drawbridge or drawbridges, wasteways and other appliances. The part of the dam used as a highway shall be maintained and operated in the same manner as the Cambridge bridge, and under the laws now or hereafter in force relating to said bridge.

Navigable  
channels to be  
dredged.

SECTION 4. The commission shall dredge navigable channels in the basin from the lock to the wharves between the dam and Cambridge bridge, to Broad canal and to Lechmere canal, the channel to be not less than one hundred feet in width and eighteen feet in depth; shall dredge Broad canal to such depths as will afford to and at the wharves thereon not less than seventeen feet of water up to the Third street draw, not less than thirteen feet of water from the Third street draw to the Sixth street draw, and not less than eleven feet of water from the Sixth street draw to the railroad draw, and not less than nine feet of water for one hundred and twenty-five feet above the railroad draw; shall dredge Lechmere canal to such depths as will afford to and at the wharves thereon not less than seventeen feet of water up to and including Sawyer's lumber wharf, and not less than thirteen feet of water from said wharf up to the head of the canal at Bent street; all depths aforesaid to be measured from the water level to be maintained in the basin.

Manner of  
dredging, etc.

The commission shall do all such dredging and all strengthening of the walls of the canals and of the



basin where dredging is done by the driving of prime oak piles two feet on centres along the front of said wharves or walls, and all removing and relocating of pipes and conduits made necessary by such dredging, so that vessels requiring a depth of water not exceeding the respective depths above prescribed can lie alongside of, and in contact with, the wharves; and this work shall be done in such manner as to cause the least possible inconvenience to abutters, and shall be finished on or before the completion of the dam; and after the walls or wharves have been so strengthened, all repairs on or rebuilding of the walls and wharves shall be done by the abutters.

The commission shall do such dredging in the basin outside of the channels aforesaid as may be necessary for the removal of sewage, sludge or any offensive deposit; shall do such other dredging as it shall deem proper, and shall take all proper measures for the destruction of malarial mosquitoes in the basin and its vicinity.

Certain other dredging to be done, etc.

SECTION 5. The commission, before the completion of the dam, shall construct marginal conduits on the north side of the basin from the outlet of the overflow channel in Binney street to a point below the dam, and on the south side of the basin from the present outlet of the Back Bay Fens to a point below the dam, and may construct an extension thereof toward, or to, St. Mary street, the conduits to be used to receive and conduct below the dam the overflow from sewers and the surface drainage and other refuse matter which would otherwise pass into the basin.

Marginal conduits to be constructed, etc.

SECTION 6. The commission, for the purpose of carrying out the provisions of the preceding sections, may from time to time take in fee or otherwise, by purchase or otherwise, for the Commonwealth, or the city of Boston or the city of Cambridge, as the commission shall determine, lands, flats and lands covered by tide water on Charles river, by filing in the registry of deeds for the county and district in which the lands or flats are situated a description thereof, sufficiently

Certain lands, etc., may be taken, etc.

accurate for identification, signed by a majority of the commissioners; and any person whose property is so taken may have compensation therefor as determined by agreement with the commission, and if they cannot agree, the compensation may be determined by a jury in the superior court for the county where the property is situated under the same provisions of law, so far as they are applicable, which apply in determining the value of lands taken for highways under chapter forty-eight of the Revised Laws, upon petition therefor by the commission, or by such person, filed in the clerk's office of said court against the Commonwealth or the city for which the lands or flats are taken within one year after the taking, and costs shall be taxed and execution issued as in civil cases.

The metro-  
politan park  
commission to  
have exclusive  
control of dam,  
etc.

SECTION 7. The metropolitan park commission, when the work provided for in the preceding sections is finished, shall, subject to the powers vested by law in the state board of health, have exclusive control of the dam and lock and of the basin and river between the dam and the city of Waltham, as a part of the metropolitan parks system, and of all poles, wires and other structures placed or to be placed on, across, over or in any part of said basin, dam or lock, and of the placing thereof, except the part of the dam used as a highway and the bridges and other structures erected by any city or town within its limits and upon its own lands; may make reasonable rules and regulations, not impairing freight traffic, for the care, maintenance, protection and policing of the basin; and throughout the year shall operate the lock without charge, maintain the lock, channels and canals aforesaid at the depths aforesaid, and clear of obstructions caused by natural shoaling or incident to the building of the dam, and maintain the water in the basin at such level, and the lock, channels and canals sufficiently clear of obstructions by ice so that any vessel ready to pass through the lock, and requiring no more depth of water than aforesaid, can pass through to the wharves aforesaid. In the event of an emergency, requiring the temporary reduction of

May make  
rules and  
regulations,  
etc.

Notice to be  
given in case  
of emergency



such level, notice thereof shall be given to the occupants of said wharves, and such reduction shall not be lower nor continue longer than the emergency requires.

requiring temporary reduction of level, etc.

Said metropolitan park commission may order the removal of all direct sewage or factory waste as a common nuisance from the river and its tributaries below the city of Waltham; and no sewer, drain, overflow or other outlet for factory or house drainage shall hereafter be connected with the basin below said city without the approval of the metropolitan park commission.

Removal of direct sewage or factory waste may be ordered, etc.

SECTION 8. The Commonwealth shall in the first instance pay all expenses incurred in carrying out the provisions of the preceding sections, and the same shall, except as provided in the following section, constitute part of the cost of construction and maintenance of the metropolitan parks system; and in addition to the amounts heretofore authorized for such construction the treasurer and receiver-general shall, from time to time, as authorized by the governor and council, issue notes, bonds or scrip, in the name and behalf of the Commonwealth, entitled Charles River Basin Loan, to the amount which the commission may deem necessary for the expenses incurred under the first six sections of this act; and all acts and parts of acts relative to loans for such construction and providing for their payment shall, so far as they may be applicable and not inconsistent herewith, apply to such notes, bonds and scrip and to their payment.

Payment of expenses.

Charles River Basin Loan.

SECTION 9. The commissioners next appointed under the provisions of chapter four hundred and nineteen of the acts of the year eighteen hundred and ninety-nine, and amendments thereof, in apportioning the expenses of maintaining the metropolitan parks system shall include as part thereof the expense of maintenance incurred under the preceding sections of this act; shall also determine, as they shall deem just and equitable, what portion of the total amount expended for construction under sections three, four, five and six of this act shall be apportioned to the cities of Boston and Cambridge as the cost of the removal of Craigie bridge and

Apportionment of expenses, etc.



the construction of a suitable bridge in place thereof, and the remainder shall be considered and treated as part of the cost of construction of the metropolitan park system. The treasurer and receiver-general shall determine the payments to be made each year by said cities, one-half by each, to meet the interest and sinking fund requirements for the amounts apportioned to them as the cost of such bridge, and the same shall be paid by each city into the treasury of the Commonwealth as part of its state tax.

City of Boston  
to do certain  
dredging,  
construct  
conduits,  
sewer, etc.

SECTION 10. The city of Boston, by such officer or officers as the mayor may designate, shall forthwith after the passage of this act do such dredging in the Back Bay Fens as the board of health of said city may require; shall construct a conduit between Huntington avenue and Charles river, to form an outlet into Charles river for the commissioners' channel of Stony brook; shall reconstruct the present connections between the river and the Fens so as to allow free access of water from the river into the streams and ponds in the Fens and thence into the river; and shall construct a sewer in the rear of the houses on the north side of Beacon street between Otter and Hereford streets. Such officer or officers may construct a conduit between Green street and Forest Hills, and may construct or rebuild within five years one or more conduits for Stony brook between the westerly side of Elmwood street and the Fens: *provided, however*, that the expense of such conduits between Green street and Forest Hills and between Elmwood street and the Fens shall be paid for out of the annual appropriation for sewer construction, under the provisions of chapter four hundred and twenty-six of the acts of the year eighteen hundred and ninety-seven and acts in amendment thereof or in addition thereto.

Proviso.

Wall or  
embankment  
may be built  
on Boston side  
of Charles  
river.

SECTION 11. The board of park commissioners of Boston may, with the approval of the mayor, build a wall or embankment on the Boston side of Charles river, beginning at a point in the southwest corner of the stone wall of the Charlesbank, thence running

such level, notice thereof shall be given to the occupants of said wharves, and such reduction shall not be lower nor continue longer than the emergency requires.

requiring temporary reduction of level, etc.

Said metropolitan park commission may order the removal of all direct sewage or factory waste as a common nuisance from the river and its tributaries below the city of Waltham; and no sewer, drain, overflow or other outlet for factory or house drainage shall hereafter be connected with the basin below said city without the approval of the metropolitan park commission.

Removal of direct sewage or factory waste may be ordered, etc.

SECTION 8. The Commonwealth shall in the first instance pay all expenses incurred in carrying out the provisions of the preceding sections, and the same shall, except as provided in the following section, constitute part of the cost of construction and maintenance of the metropolitan parks system; and in addition to the amounts heretofore authorized for such construction the treasurer and receiver-general shall, from time to time, as authorized by the governor and council, issue notes, bonds or scrip, in the name and behalf of the Commonwealth, entitled Charles River Basin Loan, to the amount which the commission may deem necessary for the expenses incurred under the first six sections of this act; and all acts and parts of acts relative to loans for such construction and providing for their payment shall, so far as they may be applicable and not inconsistent herewith, apply to such notes, bonds and scrip and to their payment.

Payment of expenses.

Charles River Basin Loan.

SECTION 9. The commissioners next appointed under the provisions of chapter four hundred and nineteen of the acts of the year eighteen hundred and ninety-nine, and amendments thereof, in apportioning the expenses of maintaining the metropolitan parks system shall include as part thereof the expense of maintenance incurred under the preceding sections of this act; shall also determine, as they shall deem just and equitable, what portion of the total amount expended for construction under sections three, four, five and six of this act shall be apportioned to the cities of Boston and Cambridge as the cost of the removal of Craigie bridge and

Apportionment of expenses, etc.



City treasurer  
to issue bonds,  
etc.

urer of the city shall, from time to time, on the request of the mayor, issue and sell bonds of the city to an amount not exceeding eight hundred thousand dollars, and the bonds so issued shall not be reckoned in determining the legal limit of indebtedness of the city.

The Boston  
and Maine  
Railroad to  
remove certain  
structures, etc.

SECTION 14. The lock shall be built above the lower line of the dam, and the Boston and Maine Railroad shall, before the dam is completed, remove its bridge, piles and any other structures in Charles river which are southerly or westerly of a line defined in red on a plan filed in the office of the board of harbor and land commissioners, marked "Plan showing line from above or southwest of which the Boston & Maine Railroad shall remove all of its structures in Charles River and between the harbor lines, May 25, 1903. Woodward Emery, Chairman of Harbor and Land Commissioners"; and may rebuild the same northerly and easterly of the line so defined. The draw in the new bridge shall not be easterly of nor more than fifty feet westerly from the location of the present draw, and shall be so located as to be directly opposite the lock. Within the limits herein prescribed the commission shall determine the position of the lock and draw.

Enforcement  
of provisions  
of act, etc.

SECTION 15. The supreme judicial court and the superior court shall, upon application of any party in interest, including any owner or occupant of property abutting on the basin or on Broad canal or Lechmere canal, have jurisdiction to enforce, or prevent violation of, any provision of this act, and any order, rule or regulation made under authority thereof.

Repeal.

SECTION 16. Chapter three hundred and forty-four of the acts of the year eighteen hundred and ninety-one, as amended by section one of chapter four hundred and thirty-five of the acts of the year eighteen hundred and ninety-three, and chapter five hundred and thirty-one of the acts of the year eighteen hundred and ninety-eight are hereby repealed.

When to take  
effect.

SECTION 17. This act shall take effect on the first day of July in the year nineteen hundred and three.  
[Approved June 24, 1903.]

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## APPENDIX B.

[CHAPTER 107 OF THE RESOLVES OF THE YEAR 1904.]

RESOLVE TO PROVIDE FOR THE ACCEPTANCE BY THE COMMONWEALTH OF THE CONDITIONS AND LIMITATIONS SET FORTH IN A CERTIFICATE OF THE ACTING SECRETARY OF WAR OF THE UNITED STATES RELATING TO THE CONSTRUCTION AND MAINTENANCE OF THE CHARLES RIVER DAM.

*Resolved*, That the express conditions and limitations set forth in a certificate of Robert Shaw Oliver, acting secretary of war, under date of the eighteenth day of May, nineteen hundred and four, relating to the construction and maintenance of a dam across the Charles river, and to the maintenance of channels in connection therewith, be, and hereby are, accepted, and the obligations thereof assumed by the Commonwealth, as follows:—

Construction of Charles river dam, etc.; acceptance of certain conditions, etc.

1. That detailed plans for the lock and dam, and of all channels to be dredged outside established harbor lines, shall be submitted to the secretary of war, and that the work be not begun until such plans have received his approval.

2. That the Charles river basin commission, or its successors, shall operate the lock, at their own expense, as a free navigable waterway of the United States, subject to such regulations as the secretary of war may promulgate.

3. That the emptying of the basin shall be subject to regulation by the secretary of war.

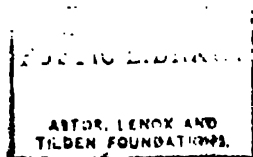
4. That the Charles river basin commission shall dredge and maintain in the basin, from the head of the lock to the channel in the river, a channel one hundred feet wide and eighteen feet deep at mean low water, in a location to be approved by the secretary of war.

5. That, whenever called upon to do so by the secretary of war, the Charles river basin commission shall deepen two and two-tenths feet the channel eighty feet wide called for by the present approved project for the improvement of Charles river by the United States, known as the project of June fourteen, eighteen hundred and eighty, the said deepening to extend as far as Brackett's wharf.

6. That the Commonwealth of Massachusetts shall maintain in the Charles river from the head of the thirty-five foot channel at Charles river bridge to the dam and lock, the necessary depth and width of channel for the commerce of the river, as fixed by the secretary of war.

7. That the alterations in the bridge of the Boston and Maine Railroad ordered by said act of the general court of Massachusetts shall be made, approval of the plans by the secretary of war being obtained, as required by law.

8. That the approval hereby granted shall not be construed as authorizing any invasion of property rights, or any act whereby a claim for damages against the United States might arise. [*Approved June 8, 1904.*]



## APPENDIX B.

5. That, whenever called upon to do so by the secretary of war, the Charles river basin commission shall deepen two and two-tenths feet the channel eighty feet wide called for by the present approved project for the improvement of Charles river by the United States, known as the project of June fourteen, eighteen hundred and eighty, the said deepening to extend as far as Brackett's wharf.

6. That the Commonwealth of Massachusetts shall maintain in the Charles river from the head of the thirty-five foot channel at Charles river bridge to the dam and lock, the necessary depth and width of channel for the commerce of the river, as fixed by the secretary of war.

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8. That the approval hereby granted shall not be construed as authorizing any invasion of property rights, or any act whereby a claim for damages against the United States might arise. [*Approved June 8, 1904.*]

THIRD ANNUAL REPORT

OF THE

*Massachusetts*  
- CHARLES RIVER BASIN  
COMMISSION.

FROM

★  
THE CHARLES RIVER BASIN COMMISSION  
367 BOYLSTON STREET



HENRY S. PRITCHETT

HENRY D. YERXA

JOSHUA B. HOLDEN

*Commissioners*

HRAM A. MILLER  
*Chief Engineer*

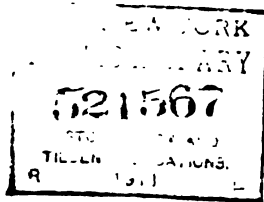
WILLIAM S. YOUNGMAN  
*Secretary*



BOSTON :  
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,  
18 POST OFFICE SQUARE.  
1906.







APPROVED BY  
THE STATE BOARD OF PUBLICATION.

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# Commonwealth of Massachusetts.

## THIRD REPORT OF THE COMMISSION.

*To His Excellency the Governor and the Honorable Council of the Commonwealth of Massachusetts.*

The Commission appointed under chapter 465 of the Acts of the year 1903, called the Charles River Basin Commission, has the honor to make the following report of its proceedings and expenditures. As required by the Revised Laws, this report is for the year ending Sept. 30, 1905.

### I. ORGANIZATION AND ADMINISTRATION.

#### (a) *The Commission, Officers and Employees.*

The membership of the Commission remains the same as in the preceding year: Henry S. Pritchett, chairman, Henry D. Yerxa and Joshua B. Holden. William S. Youngman has continued as secretary, and Hiram A. Miller as chief engineer.

The administrative office force has remained the same during the past year. Eighteen additional engineers and inspectors have been engaged during the year. Other changes and promotions in the engineering force are described in the report of the chief engineer, appended.

By the interpretation placed upon chapter 65 of the Acts of 1905 by the Attorney-General, the responsibility of operating the draw of the Craigie temporary bridge devolved upon the Commission. This advice came within a very few days of the time for opening the new draw; but fortunately a majority of the drawtenders who had gained experience in handling the draw of the old Craigie bridge were willing to enter the service of the Commonwealth. Four additional men were employed



to complete three shifts of eight hours each. Under the direction of the chief drawtender, Alfred W. Smith, the draw has been successfully operated.

(b) *Offices and Buildings.*

The office of the Charles River Basin Commission is located on the sixth floor of the Standish building, No. 367 Boylston Street. The field office of the Commission is located at No. 12 Bridge Street, East Cambridge, near the Cambridge end of Craigie bridge. The Commission also has a storehouse and work shed located at the foot of Leverett Street, near the Boston end of Craigie bridge.

II. THE DAM AND LOCK — CONSTRUCTION.

The contract for the dam and lock (Contract No. 1) was awarded to the lowest bidder who qualified, — Holbrook, Cabot & Rollins Corporation of Boston, — and was signed Jan. 14, 1905. There were eleven bids, ranging from \$1,129,530 to \$761,900, these figures being based upon quantities as estimated by the Commission's engineers. Work upon this contract was begun March 1, 1905, and has proceeded satisfactorily.

(a) *The Cofferdam on the Boston Side of the River.*

The larger coffer-dam, covering an area of  $3\frac{1}{2}$  acres of the river bottom, was nearly completed by Sept. 29, 1905. On that day the closing gap of the entire structure was made at the southwest angle. This coffer-dam is to enclose the work upon the lock and the outlet gates for the Boston marginal conduit. Some of the piles for the foundation of the lock have already been driven, and considerable dredging has been done within the area to be covered by the lock.

Details of the building of the coffer-dam on the Boston side, which is one of the largest structures of its kind ever erected in tide water, may be found in the appended report of the chief engineer.

(b) *The Cofferdam on the Cambridge Side of the River.*

Work upon the smaller coffer-dam, which is to enclose nine sluices, of which the middle and largest one is to serve the

additional purpose of a lock for small boats, was begun even before the completion of the coffer-dam on the Boston side, and the contractor is making good progress.

### III. CRAIGIE TEMPORARY BRIDGE.

By chapter 65 of the Acts of the year 1905, the Commission was authorized to provide a temporary highway bridge to take the place of old Craigie bridge, upon the site of which the dam is to be constructed. The Commission carried out the plan, stated in its second report, of utilizing the abandoned Boston & Maine Railroad bridge as a temporary highway bridge, by reconstructing a part of the same and by building highway approaches thereto, connecting Bridge Street in Cambridge and Leverett Street in Boston. These extensions were built over the land of the Boston & Maine Railroad, without any expense to the Commonwealth for the use thereof. Work was completed upon the bridge July 5, 1905.

The Acting Secretary of War, in his approval of the plan for the temporary bridge, dated Sept. 1, 1904, required the Commission to maintain a guide pier westerly of the temporary bridge until such time as the Boston & Maine Railroad shall be authorized to construct and maintain the pier. As shown by the accompanying photograph, the Commission's temporary bridge is so located that the railroad cannot construct such pier at this time, but the pier of the temporary bridge serves the same purpose for the time being.

### IV. THE MARGINAL CONDUITS.

#### (a) *The Boston Marginal Conduit—Construction.*

Contract No. 3, for Section 2 of the Boston marginal conduit (Section 1 of the conduit being included in the contract for the dam and lock), was let June 13, 1905, to James Driscoll & Son of Brookline, the lowest bidder, the total bid, according to estimated quantities, amounting to \$50,600. There were ten bids. Work was begun almost immediately, and is now nearing successful completion. Under this contract 1,805 linear feet of horseshoe conduit, equivalent in interior area to a 7-foot 3-inch diameter circle, will be built in a trench

## 1 CHARLES RIVER BASIN COMMISSION. [Jan.

averaging 21 feet in depth below the level of the Charlesbank, at an estimated price averaging about \$26 per linear foot, exclusive of engineering and supervision.

### *(b) The Cambridge Marginal Conduit.*

Throughout the year studies have been made in relation to the Cambridge marginal conduit, but as an important part of that work is affected by the dredging to be done in the Lechmere Canal, no contract has thus far been prepared.

## V. DREDGING AND PILE-DRIVING IN THE BASIN AND IN BROAD AND LECHMERE CANALS.

The Commission is required, by section 4 of chapter 465 of the Acts of 1903, to dredge navigable channels in the basin and in the Broad and Lechmere canals, and to strengthen the walls and wharves thereon by the driving of prime oak piles, 2 feet *on centers*. Work upon the specifications for the contract for the pile-driving was nearing completion on Sept. 30, 1905.

## VI. APPROVAL BY THE WAR DEPARTMENT OF THE COMMISSION'S PLANS.

Section 2 of the act establishing the Commission provides that "The commission, whenever the Commonwealth has been authorized by the United States to build a dam and lock under the provisions of this act, shall proceed to do the work herein required of it, and shall in the meantime make examinations and plans therefor."

The final plans requiring the approval of the Secretary of War, as above provided, were submitted during the previous year, and approval was given on Oct. 5, 1904.

## VII. LEGISLATION OF 1905.

The Attorney-General having expressed a doubt as to the authority of the Commission to construct a temporary highway bridge to divert the traffic from Craigie bridge during the construction of the dam, the Commission, in its second report, recommended an amendment to chapter 465 of the Acts of





DAM AND LOCK — Outside Embankment of Cofferdam at Lock.







DAM AND LOCK — Inside Embankment of Coffer-dam at Lock.





TEMPORARY BRIDGE — New Portion at Boston End.





1903, which the Legislature passed, the amendment being chapter 65 of the Acts of 1905, which will be found printed as a part of the act, in Appendix A.

#### VIII. ADDITIONAL LEGISLATION NEEDED.

##### (a) *Supply of Reports inadequate.*

Requests for the reports of the Commission have vastly exceeded the supply. The Commission is given for distribution only 350 copies, and it has been found that many important offices in the cities and towns affected by the improvements being carried on by the Commission are without its reports. The Commission therefore recommends that it be authorized to print an edition of 3,000 of this and future reports, also to reprint editions of 1,000 copies each of the first and second reports.

##### (b) *Machinery of Drawbridges under Same Control as Machinery of Lock.*

The studies of the engineers upon plans for the machinery to operate the lock gates and the drawbridges over the lock indicate the desirability of having the machinery of both the drawbridges and the lock under control of the same Board. This arrangement will be in the interest of economy, and will better provide for the safety and convenience of the public using the highway and of vessels passing through the lock. Chapter 465 of the Acts of 1903 gives to the Metropolitan Park Commission the control of the lock, and to the Commissioners of Cambridge Bridges the control of that portion of the dam which serves as a bridge. The Commission recommends that chapter 465 of the Acts of 1903 be amended to give authority over the operation of the drawbridges and over the operation of the lock to the same commission.

#### IX. TAKINGS OF PROPERTY.

Certain buildings on piles near the Boston end of Craigie bridge and attached thereto, and the land beneath the same, covered by tide water, claimed by the heirs of Caroline M. McGlenen, were taken Feb. 18, 1905.



The property of George O. Proctor, next adjoining the Cambridge end of Craigie bridge, and necessary for an approach to the dam, was taken June 26, 1905.

#### X. CONTRACTS AWARDED.

Besides the larger contracts, — No. 1 for the dam and lock and No. 3 for a section of the Boston marginal conduit, — seventeen smaller contracts were awarded during the year. Upon all of these, except upon Contract No. 2, with the United States Wood Preserving Company for paving, satisfactory work has been done.

The following is a complete list of contracts let prior to Oct. 1, 1905:—

No.	Name.	Work.	Amount.	Date.
1	Holbrook, Cabot & Rollins Corporation.	Dam and lock in the Charles River.	\$801,607 50	Jan. 14, 1905.
2	United States Wood Preserving Company.	Wooden block paving for temporary bridge.	11,700 00	Mar. 23, 1905.
3	James Driscoll & Son, . .	Section 2 of the Boston marginal conduit.	50,600 00	June 13, 1905.
4	Camden Iron Works, . .	Cast-iron pipes and special castings.	5,640 75	July 18, 1905.
5	Henry R. Worthington, .	Furnishing and erecting pumps.	9,533 00	Sept. 30, 1905.
6	Gibby Foundry Company, .	Castings and other metal, .	6,013 74	July 27, 1905.
7	Geo. McQuesten Company, .	Yellow pine lumber for temporary bridge.	12,476 58	Feb. 14, 1905.
8	Rockport Granite Company,	Granite paving blocks for temporary bridge.	1,927 10	Mar. 22, 1905.
9	New England Granite Company.	Granite edgestones for temporary bridge.	525 00	Mar. 22, 1905.
10	General Electric Company, .	Motors for draw in temporary bridge.	812 50	Mar. 22, 1905.
11	E. D. Sawyer Lumber Company.	Spruce lumber for temporary bridge.	4,495 43	Mar. 23, 1905.
12	Harrington, Robinson & Co.,	Tees for wheel-guard on temporary bridge.	817 08	Mar. 29, 1905.
13	Aberthaw Construction Company.	Twisted steel rods for reinforcing concrete.	5,219 20	May 29, 1905.
14	Gibby Foundry Company, .	Castings for overflow, Boston marginal conduit.	736 80	July 22, 1905.
15	Coffin Valve Company, .	Composition at dam and lock.	1,773 44	July 31, 1905.
16	The Boston Bridge Works, .	Brackets for lock gate bearings at lock.	1,301 30	Aug. 2, 1905.
17	The Lumsden & Van Stone Company.	Welded pipe for electric conduits under lock.	3,972 75	Aug. 18, 1905.
18	The Ludlow Valve Manufacturing Company.	Gate valves at lock, . .	861 95	Aug. 25, 1905.
19	The Scherzer Rolling Lift Bridge Company.	Plans, specifications, engineering and patent rights for superstructure, operating machinery, etc., for drawbridge over lock.	4,500 00	Aug. 25, 1905.

A more detailed account of these contracts may be found in the chief engineer's report, appended.



BOSTON MARGINAL CONDUIT — Excavation in Sheeted Trench.





On the above contracts the following amounts were reserved on monthly estimates, and are not due until the completion of the contracts, or until final settlement:—

Name.	Work.	Amount.
Holbrook, Cabot & Rollins Corporation.	Dam and lock, . . . . .	\$17,987 67
United States Wood Preserving Company.	Wooden block paving for temporary bridge.	843 98
James Driscoll & Son, . . . . .	Section 2 of the Boston marginal conduit.	2,289 25
		\$21,120 90

# XI. HEARINGS.

During the year the Commission gave the following hearings: to the representatives of the wharf owners on the Broad and Lechmere canals and on Charles River basin, represented by Mr. William A. Hunnewell, Mr. Albert M. Barnes and Mr. J. Frank Wellington, two hearings, relative to work in front of the walls and wharves in the canals and on the basin; to representatives of the barge lines and tow-boats, relative to the bringing of barges through the draw of the temporary bridge; to Mr. George G. Crocker and Mr. Frederic D. Fisk, trustees of the Main Street land trust, relative to the use of their gravel and sand in the construction of the dam; to Mr. George O. Proctor, owner of the land needed for the approach to the dam on the Cambridge side, relative to the proposed taking of his property; to the Commissioners of Cambridge Bridges and representatives of the Boston Elevated Railway Company, relative to paving to be used on the temporary bridge; to Mr. Henry Parkman, Mr. Edmund D. Codman, Mr. Henry G. Vaughan and Dr. J. Payson Clark, representing the Union Boat Club, relative to the location of their boat-house in relation to the Boston marginal conduit; to Mr. A. B. Clements and Mr. Alex. Reed, vice-presidents of the United States Wood Preserving Company, and Mr. B. T. Wheeler, their engineer, relative to remedies for defects in their paving of the temporary bridge.

## XII. ISSUE OF BONDS.

On the twenty-seventh day of December, 1904, the Commission voted to advise the Treasurer of the Commonwealth to make available additional funds to the amount of \$400,000 for the year 1905. Bonds to the amount above named were issued under the title of the Charles River basin loan, and sold by the Treasurer. The total issue of bonds on account of the Charles River basin loan, to Oct. 1, 1905, is \$650,000.

## XIII. PAYMENTS TO THE SINKING FUND.

Payments to the sinking fund of the Charles River basin loan during the year have amounted to \$27,384.26. The total payments to the sinking fund, to Oct. 1, 1905, amounted to \$38,691.80.

## XIV. MISCELLANEOUS.

Fifteen hundred copies of the second annual report of the Commission were printed, of which 100 copies were bound in cloth, at a total cost of \$454.27.

## XV. STATEMENT OF EXPENDITURES.

The total amount of expenditures for the year beginning Oct. 1, 1904, and ending Sept. 30, 1905, is \$212,684.67. The total amount from July 29, 1903, the date of the organization of the Commission, to Sept. 30, 1905, is \$263,072.14.

The general character of these expenditures is as follows:—

	For the Year ending Sept. 30, 1905.	From Beginning of Work to Sept. 30, 1905.
<i>Administration.</i>		
Commissioners, . . . . .	\$10,000 00	\$21,358 02
Secretary, . . . . .	2,147 22	2,383 33
Clerks and stenographers, . . . . .	658 84	1,136 84
Travelling, . . . . .	76 49	208 19
Stationery and printing, . . . . .	914 97	1,167 90
Postage, express and telegrams, . . . . .	44 74	52 96
Furniture and fixtures, . . . . .	53 86	312 11
Alterations and repairs of building, . . . . .	-	123 10
Telephone and lighting, . . . . .	79 71	140 41
Rent, . . . . .	285 72	720 24
Miscellaneous expenses, . . . . .	41 52	92 52
	\$14,303 07	\$27,695 62
<i>Amounts carried forward, . . . . .</i>	\$14,303 07	\$27,695 62





DAM AND LOCK — Westerly Side of Coffe-dam at Lock.



	For the Year ending Sept. 30, 1905.	From Beginning of Work to Sept. 30, 1905.
<i>Amounts brought forward,</i>	\$14,303 07	\$27,695 62
<i>Engineering.</i>		
Chief, principal assistant and division engineers,	\$10,725 00	\$20,594 24
Engineering assistants,	16,481 90	26,975 99
Consulting engineers,	2,400 90	5,300 90
Inspectors,	3,118 46	3,118 46
Architect,	-	582 00
Traveling,	173 69	363 55
Wagon hire,	8 50	58 60
Stationery and printing,	975 10	1,654 67
Postage, express and telegrams,	39 81	80 09
Instruments and tools,	639 05	2,731 86
Engineering and drafting supplies,	235 79	532 72
Books, maps and photographs,	414 45	614 48
Furniture and fixtures,	515 08	1,888 99
Alterations and repairs of building:—		
Main office,	-	1,092 14
Sub-office,	214 06	214 06
Telephone and lighting,—main office,	178 87	377 88
Telephone, lighting, heating and care of building,—sub-office,	139 12	194 88
Rent,—main office,	1,714 32	3,446 47
Rent of field office,	146 45	251 45
Unclassified supplies,	52 40	65 94
Miscellaneous expenses,	71 69	95 03
	38,244 64	70,234 30
<i>Construction—Preliminary.</i>		
Labor,	\$854 83	\$5,000 94
Traveling,	92	19 08
Water rates,	-	3 45
Freight and express,	50 25	51 17
Jobbing and repairing,	1 04	35 68
Tools, machinery, appliances and hardware supplies,	75 34	185 76
Castings, ironwork and metals,	120 58	201 54
Iron pipe and valves,	19 81	98 96
Fuel, oil and waste,	16 80	62 65
Lumber,	229 54	338 08
Cement,	-	24 75
Sand,	-	3 00
Unclassified supplies,	10 99	14 69
Miscellaneous expenses,	10 23	355 84
	1,390 33	6,395 59
<i>Construction—Contracts.</i>		
Contract No. 1, Holbrook, Cabot & Rollins Corporation,	\$101,930 12	\$101,930 12
Contract No. 2, United States Wood Preserving Co.,	4,782 52	4,782 52
Contract No. 3, James Driscoll & Son,	12,972 44	12,972 44
Contract No. 7, Geo. McQuesten Co.,	12,476 58	12,476 58
Contract No. 8, Rockport Granite Co.,	1,927 10	1,927 10
Contract No. 9, New England Granite Co.,	525 00	525 00
Contract No. 10, General Electric Co.,	812 50	812 50
Contract No. 11, E. D. Sawyer Lumber Co.,	4,495 43	4,495 43
Contract No. 12, Harrington, Robinson & Co.,	817 08	817 08
Contract No. 13, Aberthaw Construction Co.,	4,614 80	4,614 80
Contract No. 15, Coffin Valve Co.,	2 35	2 35
	145,355 92	145,355 92
<i>Construction—Additional.</i>		
Labor,	\$4,394 74	\$4,394 74
Traveling,	86	86
Freight and express,	4 30	4 30
Jobbing and repairing,	172 97	172 97
Tools, machinery, appliances and hardware supplies,	4,695 66	4,695 66
Castings, ironwork and metals,	196 33	196 33
Iron pipe,	6 91	6 91
Paint,	7 00	7 00
Fuel, oil and waste,	38 53	38 53
Lumber,	3,088 91	3,088 91
Stone,	4 00	4 00
<i>Amounts carried forward,</i>	\$12,610 21	\$249,081 43

	For the Year ending Sept. 30, 1905.		From Beginning of Work to Sept. 30, 1905.	
<i>Amounts brought forward,</i> . . . .	\$12,610 21	\$190,203 96	\$12,610 21	\$249,681 43
<i>Construction — Additional — Con.</i>				
Sand, . . . . .	4 00		4 00	
Corporation work, . . . . .	266 97		266 97	
Unclassified supplies, . . . . .	188 96		188 96	
Miscellaneous expenses, . . . . .	160 88		160 88	
		13,231 02		13,231 02
<i>Real Estate.</i>				
Legal and expert, . . . . .	\$159 69		\$159 69	
		159 69		159 69
Totals, . . . . .		\$212,684 67		\$263,072 14

The foregoing expenditures have been distributed among the various objects or works as follows : —

	For the Year ending Sept. 30, 1905.	From Beginning of Work to Sept. 30, 1905.
Administration, applicable to all parts of the work,	\$14,303 07	\$27,695 62
Dam, . . . . .	23,568 19	38,881 31
Lock, . . . . .	61,100 29	60,395 21
Temporary bridge and approaches, . . . . .	76,884 81	77,869 65
Drawbridge, . . . . .	8,143 00	8,859 56
Highway, . . . . .		60 92
Dredging in basin, . . . . .	153 62	674 91
Broad Canal, . . . . .	1,006 39	2,961 12
Lechmere Canal, . . . . .	628 28	1,537 90
Boston marginal conduit, . . . . .	26,619 17	34,206 19
Cambridge marginal conduit, . . . . .	187 85	929 75
Totals, . . . . .	\$212,684 67	\$263,072 14

The report of the chief engineer follows.

In Appendix A will be found, indexed, chapter 465 of the Acts of 1903, as amended by chapter 65 of the Acts of 1905.

In general, the Commission desires to report a successful year of work and progress, at as rapid a rate as it had anticipated. The Commission desires at the same time to express its indebtedness to the secretary and to the efficient engineering staff for the results achieved.

Respectfully submitted,

HENRY S. PRITCHETT,  
HENRY D. YERXA,  
JOSHUA B. HOLDEN,

*Charles River Basin Commission.*

Boston, Jan. 4, 1906.



## REPORT OF THE CHIEF ENGINEER.

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*To the Charles River Basin Commission.*

GENTLEMEN : — The following is a report of the work of the engineering department for the year ending Sept. 30, 1905.

### ORGANIZATION.

Mr. Frank E. Winsor continued as division engineer until May 21, 1905, when he was promoted to the position of principal assistant engineer. His duties consisted mainly of designing, drafting and other office work, although he occasionally supervised some of the field work.

Mr. John L. Howard continued as division engineer, in charge of field work.

Mr. Frederic P. Stearns continued to act as consulting engineer.

Mr. Guy Lowell was consulted in architecture and landscape architecture.

Mr. J. R. Worcester was consulted in regard to designs for lock gates and appurtenances, and other problems connected with structural steel work.

The engineering force at the beginning of the year numbered 18, and was increased from time to time as the work required, until at the end of the year it numbered 35.

The names of the assistants in the engineering department, not mentioned above, who have been employed for not less than one month, are given below, with the positions last held, together with an indication of the work performed by them : —



*Assistant Engineers.*

JOHN N. FERGUSON, . . .	Hydraulic studies, estimates and miscellaneous office work, until June 15, 1905; subsequently, field work.
EDWARD C. SHERMAN, . . .	Designs and studies for steel work and masonry.
J. ALBERT HOLMES, . . .	Field work.
LEONARD P. WOOD, . . .	Hydraulic studies and designs for masonry.
WILLIAM C. PICKERSGILL, . . .	Designs and studies for masonry, tests of yellow pine timber, and miscellaneous office work.

*Inspectors.*

DANIEL A. STORY, . . .	Inspector of piling and bridge work.
ARTHUR I. PLAISTED, . . .	Engineering inspector.
FRANKLIN L. MASON, . . .	Inspector of masonry.
DANIEL J. SULLIVAN, . . .	Inspector of piling, bridge work and paving.
WALTER N. CHARLES, . . .	Engineering inspector.
GEORGE L. BOSWORTH, . . .	Assistant inspector.

*Draftsmen, Instrumentmen, etc.*

WALTON H. SEARS, . . .	Mechanical assistant.
WALTER R. KATTELLE, . . .	Draftsman.
JENNIE L. RAWSON, . . .	Clerk and stenographer, — administrative work, accounts and letters.
HERBERT W. OLMSTED, . . .	Instrumentman.
MORTON F. SANBORN, . . .	Instrumentman.
FREDERIC C. H. EICHORN, . . .	Instrumentman.
ROBERT E. BARRETT, . . .	Instrumentman.
WALTER E. WHEELER, . . .	Instrumentman.
NORMAN C. MCNEIL, . . .	Instrumentman.
JOHN M. O'DONOGHUE, . . .	Instrumentman.
ETHELYN B. MARLATTE, . . .	Clerk and stenographer.
ALBERT J. HOLMES, . . .	Draftsman.
JAMES E. BARLOW, . . .	Rodman.
BERTRAM I. HALL, . . .	Rodman.
THOMAS J. LONG, . . .	Rodman.
FRANK V. ANDREWS, . . .	Rodman.
EDITH F. WHITE, . . .	Stenographer.
FRANK A. McDONALD, . . .	Rodman.
EDWARD L. LINCOLN, . . .	Rodman.
RED WM. TREEN, . . .	Clerk and messenger.

Mr. Arthur W. Tidd, who was employed as assistant engineer during the greater portion of the previous year, resigned on Oct. 15, 1904, to accept a position as assistant engineer with the Aqueduct Commission of the city of New York.

In addition to the above regular employees, Mr. Herbert L. Sherman, having a chemical and cement-testing office at 220 Devonshire Street, Boston, had charge of cement testing; and Mr. William R. Conard of Burlington, N. J., had charge of inspection of pipes manufactured at Camden, N. J., under a contract with the Camden Iron Works.

The principal engineering office was continued at 367 Boylston Street, Boston, and the office for the field force was continued at 12 Bridge Street, East Cambridge. This field office was enlarged during the latter part of March by the occupancy of the entire space of the first and second floors. On the second floor a partition was removed and three additional windows put in, making a drafting room, 24 feet by 16 feet, well lighted.

#### DAM AND LOCK.

This important portion of the work to be done by the Commission occupied the engineering staff, both in the office and in the field, for the larger proportion of the year. A general description of this, together with the construction work thereon, is submitted herewith.

The contract plans were well advanced at the end of the previous year, and the specifications and plans were completed in time to advertise for bids early in November, bids being opened on Dec. 20, 1904. These plans were of necessity somewhat general in character, and details were left for future consideration. These details very largely occupied the attention of the office force during the year.

Working drawings were in progress during the year, of masonry, pile plans, steel reenforcement of concrete, and miscellaneous details.

It having been decided to make a taking of the entire property in Cambridge between Lechmere Canal and Bridge Street, extending from the river to Commercial Avenue, and also to fill between the rest pier at the up-stream end of the lock and



the Boston side of the river, a new plan, approved by the consulting landscape architect, was made, a copy of which (Plan No. 2) is submitted herewith.

*Approval of the War Department.*

The final plans requiring the approval of the Secretary of War, submitted during the previous year, were approved on Oct. 5, 1904, thereby removing the last obstacle in the way of actual construction.

*Coffer-dam at the Boston Side of the River.*

The contract for the dam and lock provides that the contractor may use the design of coffer-dams submitted with the contract plans, or such other design of his own as the engineer may approve.

Various designs for the coffer-dam on the Boston side were considered by the contractor, and a detailed study was given to the merits of the various suggestions. A final type of dam was submitted by the contractor and approved by the engineer, which differed mainly from the original design, in that the two rows of sheeting called for were spaced 8 feet instead of 30 feet apart, and additional earth filling was required in order to give substantially the same stability as the original design. As built, the coffer-dam consists of two rows of 6-inch yellow pine sheeting, "square edge" classification, 8 feet apart in the clear, with 1½-inch by 3-inch spruce splines. Round guide piles of spruce or Norway pine, 12 inches in diameter at the butt, were driven 10 feet on centers, with one spurshore pile at each bent, first on one side and then on the other. There are two lines of lower wale timbers, consisting of 6-inch by 10-inch yellow pine, with centers at elevation 102.5, and between the round piles at the same elevation were fitted 10-inch by 10-inch yellow pine sticks. These were bolted to each other with three ¾-inch bolts, and at each end of the 10-inch by 10-inch sticks are 1¼-inch diameter tie rods, some 12 feet long, extending between each line of sheeting, wales, etc. The centers of the upper wales, also 6-inch by 10-inch yellow pine, are at elevation 110.5, and between the round piles at this elevation are 6-inch

by 12-inch, or larger, yellow pine filling pieces. These were bolted through with two  $\frac{3}{4}$ -inch bolts, and through each end of the filling pieces were bolted  $1\frac{1}{4}$ -inch tie rods, some 12 feet long. Between the two lines of sheeting at both the top and bottom wales, opposite the round piles, were placed 8-inch by 10-inch yellow pine braces, strengthened by 3-inch by 10-inch spruce cross-bracing spiked to the large braces. The filling between the two rows of vertical sheeting is largely of a fine, silty sand, mixed in places with clay and gravel from the channels in the lower harbor. The earth filling on the river side of the coffer-dam is mainly of clay and gravel, and approximates a 2 to 1 slope, with the top at elevation 105. The top of the embankment on the lock side is at elevation 110, with a width of 25 feet and a side slope of 2 to 1. For a depth of 4 feet on top and some 10 feet on the slope the embankment consists of sand and gravel, to allow the embankment to drain freely when the coffer-dam should be pumped out. The portion next the sheeting is made of more impervious material. Where the ends of the coffer-dam come in contact with the Charlesbank wall, a trench was made through the wall after the stones had been entirely removed, and the two lines of sheeting were brought together a short distance inside of the wall. For boring the holes required for the bolts and tie rods in the coffer-dam, the contractor fitted up a small scow with an air-compressor plant, and most of the holes were bored by the aid of compressed air.

Early in the spring the drawtenders' house and other buildings on the down-stream side of the bridge were removed. In June piles were driven at the southerly end of the coffer-dam, to support the sluices.

In order to permit the water to rise and fall with the tide inside the coffer-dam when the closure in the sheeting was being made, the contract provided that the sluices in this coffer-dam should have an area of not less than 36 square feet, and that the middle of the sluices should not be above elevation 102.5. As built, there were two openings, each 5 feet 6 inches high, the larger opening being 5 feet wide and the smaller one 2 feet 6 inches wide. These extended through the embankment in the dam in one flume about 40 feet long, 5 feet 6



inches high, and tapering from a width of 14 feet at one end to a width of 10 feet at the other end. The gates for the sluices were built of 8-inch spliced yellow pine timber, and were fitted with a creek end pinion for hand operation.

At 2 a. m. on July 5, the temporary bridge having been completed, the work of tearing down the old draw and other portions of the bridge which interfered with the construction of the coffer-dam was begun; and by the end of the week all of the draw had been removed, and the piling for the coffer-dam was being driven where the bridge had been removed.

In order to protect the lower end of the coffer-dam from being damaged by vessels passing through the draw of the temporary bridge, a fender was built some 15 feet below the lower line of sheeting, consisting of piles 8 feet on centers, with a spurkane to each pile and double spurkanes on alternate piles, and with three lines of double girder caps, — one at mean tide, one at mean high water and the other at about elevation 115. On top of the top row was placed an 8-inch by 10-inch rider cap.

On September 29 the closing gap in the entire structure was made at the southwest angle.

In the construction of this coffer-dam 137 round piles, 716 M. feet B. M. of yellow pine timber, 606 scow loads and 4,617 cart loads of earth were used. The earth delivered by scows came from the excavations for the lock, from the river above the Cambridge bridge, and from the dredging in the harbor. The earth delivered by carts came from the excavations for the Boston marginal conduit, and for the subway under construction by the Boston Transit Commission, and from other sources.

#### *Excavation for the Lock.*

The excavation for the foundation of the lock was started April 27. The surface material, being considered unsatisfactory for use in the coffer-dam, was deposited within the cross-section of the dam, as near the Cambridge shore as it could be placed without interfering with the construction of the sluices. The remainder of the material excavated at the lock was used in the construction of the coffer-dam.





DAM AND LOCK — Bracing in Coffe-dam for Lock.





DAM AND LOCK — Sluices in Cofferdam at Lock.





*Foundations of the Lock.*

At the request of the contractor, permission was given, before the lock was pumped out, to drive some 500 piles at the lower 40 feet of the lock, where the masonry projected into the inside slope of the coffer-dam; with the understanding that if, after the coffer-dam was pumped out, any piles were found to be out of place or improperly driven, the contractor would drive other piles in the proper places without expense to the Commission.

*Lock Gates.*

The question of final design of lock gates was taken up about the middle of the year, and the various conditions to which these gates might be exposed in extreme cases were considered in making the design. It was thought desirable to provide for the possibility of the lock being used as a flood sluice during extraordinary upland floods. This necessitates that both gates be open at the same time, the last one being opened on a falling tide, when the tide and basin are at the same level. The gates have been so designed that in case this use should be attempted unsuccessfully, through failure to get the gate open more than part way before the falling tide causes sufficient pressure on the up-stream side of the gate to prevent the completion of the operation, the consequent pressure due to the head of water on the basin side of the gate would do it no injury. This necessitates very heavy construction for the top girders and for the bearings for the lock gates.

The lower lock gate has been designed in detail. The bearings and other metal work connected with the gates have also been decided upon. The filling gates, also, which are to be a part of the lock gate structures, were considered in detail. The designs for the operating mechanism, which will consist of chains running over sprocket wheels and driven by electric motors, had been carried nearly to completion at the end of the year.

*Stop-planks at Lock.*

The lock has been so designed that, if necessary, stop-planks can be placed at either end of the lock, and the lock pumped out. The design of these stop-planks, which are required to



span an opening 45 feet in width, with a maximum depth on the down-stream side of about 32 feet and on the up-stream side of 21 feet, involved considerable study. At the end of the year details had been completed, which consist of trusses spanning the lock near the top and supporting two vertical steel girders, which divide the width of the lock into three spaces, with provision for stop-planks to span these spaces. These stop-planks are of wood, reenforced with a sufficient amount of metal to give them the required strength and to insure their sinking in the water.

#### *Metal at Lock.*

Detail plans of a considerable part of the metal at the lock were made, and the work contracted for in the latter part of the year. These plans included steel for reenforcing concrete; adjustable bearings for the lock gates, capable of taking the maximum pressures due to extreme conditions on the gates; manhole frames and covers; anchorages for holding lock gate bearing timbers in place in the masonry; steel brackets for supporting rear lock gate bearings; bed plates for operating machinery; cast-iron pipe for suction and discharge from pump-wells, for conduit under lock and for gage pipes; and lap-welded pipes for electric ducts under the lock.

The question of specifications for steel rods for reenforcing the masonry was given detailed study; and a schedule for steel which it was estimated might possibly be required during the season of 1905 was prepared, and a contract let on May 29 for these rods.

#### *Heating Plant.*

The legislative act establishing the Commission requires the lock to be operated throughout the year, and much study was made of various methods for keeping the lock gates free from ice. Tentative designs were made of a boiler plant in the lower lock gate-house, of sufficient size to heat both lock gates in such manner as to permit their operation in the coldest weather, to heat the superstructures at the two lock gates, and to provide sufficient heat at the sluices to warm the gate-chambers and to insure the sluice gates from freezing.

In connection with the design for heating, it was considered desirable to get more positive data than existed in any available technical literature, from which to draw conclusions as to the size of plant required and the best method of manipulation. The problem appeared to be a novel one, and as very little satisfactory information could be obtained in reference to it, it was decided to make some experiments, to determine, if possible, some of the doubtful factors. These experiments may be briefly described as follows : —

The experiments were made at the upper Mystic Lake. The old gate-house of the Boston water works, located on the Medford shore near the dam, made a satisfactory boiler house and a place to store instruments and tools. This house was kindly placed at the disposal of the Commission by the Metropolitan Water and Sewerage Board.

The experimental apparatus consisted of a 5 horse-power vertical tubular boiler and two concentric steel tanks 5 feet high, the outer tank being 4 feet in diameter and the inner tank 3 feet in diameter, bolted together at the bottom, thus leaving a 6-inch annular space between the tanks, in which were placed two double-turn coils of 1-inch pipe, each entering from and returning to the interior of the inner tank, and so arranged that steam could be supplied to either or both. In addition to these coils, there was at the bottom of the annular space a third coil, of  $\frac{3}{4}$ -inch pipe perforated with  $\frac{1}{16}$ -inch diameter holes pitched about 2 inches. Steam could also be supplied to this coil. The tanks were suspended by chain falls from an overhead framework built upon an old timber structure in the pond near the gate-house. The tanks were so suspended that they could be raised entirely above the surface of the water, or lowered so as to be almost entirely submerged. The method of conducting the tests was as follows : —

The tanks were partially submerged and allowed to freeze in, usually over night or longer. They were then warmed by one of the following methods until free from the surrounding ice, and sufficient heat was applied to prevent the further formation of ice around them. Three methods of heating were tried : No. 1, using the radiator coils of 1-inch pipe, with air in the annular space ; No. 2, using these same coils with water in the

1. The first step in the process is to identify the problem or goal. This involves understanding the current situation and what needs to be achieved.

2. Next, it is important to gather relevant information and data. This can be done through research, interviews, or other methods.

3. Once the information is gathered, the next step is to analyze it. This involves identifying patterns, trends, and potential solutions.

4. After analysis, the next step is to develop a plan or strategy. This should outline the steps needed to achieve the goal.

5. The final step is to implement the plan. This involves putting the strategy into action and monitoring progress.

6. Throughout the process, it is important to communicate and collaborate with others. This can help ensure that everyone is on the same page and working towards the same goal.

7. Finally, it is important to evaluate the results of the process. This can help determine if the goal was achieved and if the process was effective.

[illegible]



variations of timber alternately wet and dry, was desired. The possibility of using timber treated by a preservative process, which would exclude moisture and thus prevent swelling, was considered, and various preservative processes were investigated. It was found that the only preservative which is insoluble, and thus can be used to advantage on timber immersed in water, is one containing creosote. It was decided to make some experiments to determine the value of the preservative in excluding moisture, and to learn the amount of increase in dimensions of both treated and untreated timber when immersed in water. Ten pieces of long-leaf yellow pine, 4 inches by 12 inches, 6 inches by 14 inches and 12 inches by 12 inches, about 24 feet long, and four pieces of white oak, 4 inches by 12 inches, 8 inches by 8 inches and 14 inches by 14 inches, about 20 feet long, were cut in halves, and one half of each timber was treated by a creosote preservative process, while the other half was left untreated. These timbers, when well dried, were weighed and carefully measured by the aid of a micrometer caliper to .001 of an inch, after which they were put in water and weighed and measured from time to time for some three months. At the end of this time the greater part of these timbers had apparently reached the maximum of increase in weight and size. The variations in weight and dimensions of the treated timbers were found to be very slight; but since it was noted that some of the preservative appeared to be washing out, a further increase might be expected. The increase in dimensions was far greater in the untreated than in the treated timbers. For the six untreated long-leaf yellow pine sticks the increase in dimensions varied from a minimum of .04 per cent. to a maximum of 1.03 per cent., with an average of .43 per cent.; the stick giving the maximum value contained a large percentage of sap-wood, and if this stick were neglected, the maximum would become .53 per cent. and the average .31 per cent. For the four oak sticks the increase in dimensions varied from a minimum of .12 per cent. to a maximum of .33 per cent., with an average of .21 per cent. Some of the timbers have been left soaking in the tanks, so that further measurements may be made to demonstrate with greater certainty that the ultimate increase in weight and dimensions has been reached.

In connection with and following these tests made on the larger timbers, similar tests were made upon creosoted paving blocks. Thirty-three blocks were used in this set of tests. As it was possible to weigh the blocks much more accurately than the large timbers, the determination of the maximum absorption was much more accurately made. To determine the desirability of the preservative and to approximate an accelerated weathering, some of the specimens were dried after being immersed, and then immersed again; and others, when the maximum absorption was reached, were placed in cold storage and frozen.

A considerable part of the work of the timber tests was done at the Massachusetts Institute of Technology, being in part connected with thesis work.

#### *Superstructures.*

The superstructures over the two lock gates were studied in detail, and preliminary designs were made. The architectural features were studied in sufficient detail to settle definitely on the foundations required, which it is expected will be included in the contract for the dam and lock.

#### *Drawbridge.*

Some form of bascule bridge was decided upon during the previous year. Various bridges of this type were investigated, and detail studies made of their advantages and disadvantages. The type of bridge designed and patented by The Scherzer Rolling Lift Bridge Company was finally decided upon, and a contract made with that company on August 25 for the design of a single-leaf structure in two parts. Some of the advantages of a single-leaf structure are that it can be raised entirely on the Cambridge side of the lock, and will permit an unobstructed view from the operator's tower, as described below, of the pier below the draw; also, that it permits of somewhat simpler overhead construction for the trolley poles and wires of the electric railway, and does away with the opening across the roadway at the middle of the lock, which would be necessary in a double-leaf structure. The bridge is to be built in halves, operated by independent motors. This plan was adopted



principally on account of the width of the bridge, which is 85 feet. It is expected that it may be found desirable to operate one half at a time, before vessels have cleared the entire bridge, and thus shorten the time during which street traffic will be interrupted. It is also desirable to have a bridge operated in halves in order that, in case of accidents, one half of the bridge may be maintained for traffic while the other half is being repaired.

The adoption of this type of bridge necessitated considerable work in the study and design of retaining walls, etc., for the substructure.

#### *Operation of Lock and Drawbridge.*

Much study was given to the question of operation of the lock for passage of vessels, and to designs for warping machinery. Detail studies were made for a number of warping machines, but no positive conclusion had been reached at the end of the year. The time required for vessels of various sizes to pass through the lock and draw was calculated as closely as the various uncertainties of the problem would permit. In this connection a number of foreign articles in reference to the operation of lock gates, canals, etc., were partially translated.

Careful studies were made of various methods for operating the drawbridge, lock gates, filling gates, warping machines, etc., to the end that highway traffic be interrupted as short a time as possible, and that the passage of vessels through the lock be made with as great rapidity as is consistent with safety. A tentative decision was reached to have all the operations connected with opening and closing the drawbridge, opening and closing the lock gates, and controlling the filling gates for balancing the water level in the lock, performed at a single point and under the control of a single operator, this operator to be located in the tower, which will be made a part of the building over the lower lock gate recess. The tower is to be of sufficient height to enable the operator to get a substantially unobstructed view across the drawbridge, down the river and along the lock to the upper pier in the basin. The arrangement will be similar in principle to that of a railroad switch tower, and the responsibility for the manipulation of all the apparatus at this point will rest almost entirely on a single

individual. It may be noted that an arrangement of this kind will be somewhat difficult under existing legislation, as it is provided that the drawbridge and its operation be under the control of the Boston and Cambridge Bridge Commission, and that the lock and its operation be under the control of the Metropolitan Park Commission. It is therefore suggested that the attention of the Legislature be called to this point, and that a modification of the law, more easily to permit of this arrangement, be asked for.

#### *Pumps.*

The pumping plants required for pumping out the upper and lower lock gate recesses at the lock and the main lock itself will consist of a 13,000-gallon-per-minute, vertical, centrifugal pump, with direct-connected variable-speed motor at the lower lock gate-house; and a 5,000-gallon-per-minute, vertical, centrifugal pump, with direct-connected variable-speed motor at the upper lock gate-house. The pumping plant required at the sluices will consist of a 1,200-gallon-per-minute, horizontal pump, with direct-connected variable-speed motor, designed so that it can be occasionally submerged without injury.

Studies for the capacities and general design for these pumps were made, and specifications were drawn up and bids received on July 25. The bids, with accompanying designs and guaranteed efficiencies, were studied in detail, and as accurate analyses as possible made of the advantages of the various types of pumps and appurtenances. Consideration was given to the merits of design and details of construction, as well as to the price; and the previous experience of bidders in building pumps of the type required to operate under the conditions which will exist at the dam and lock was carefully looked up. Pumping plants installed at Schenectady and Buffalo, N. Y., were visited in connection with these studies.

A contract for these three pumps has been made.

#### *Sluices.*

Other detail studies of the sluices not mentioned elsewhere include detail design of steel and concrete roof, studies of discharge through the sluices under various conditions of river flow and tides, and study of design of gates for the central



sluice, which will be fitted to serve also as a lock for small boats.

The hydraulic conditions determining the capacity of the sluices and other openings through the dam are as follows:—

The largest freshet of which any record is obtainable occurred in February, 1886. During this freshet records were kept of the discharge over the dam and through the wheels of the Boston Manufacturing Company, near Moody Street, Waltham. These records, supplemented by additional levels and measurements, have been carefully studied, and it is estimated that the maximum discharge at this point during the flood was 3,968 cubic feet per second. The watershed of the Charles River above the dam of the Boston Manufacturing Company, as shown on Plan No. 1, is 251 square miles, but a portion of the flow of the river passes through Mother Brook into the Neponset River. The amount passing into Mother Brook is regulated by two weirs, one in the Charles River a short distance below the Newton water works pumping station, the other in Mother Brook in Dedham just above Washington Street. These two weirs are at the same elevation, the one in the Charles River being 60 feet long, while the one in Mother Brook has a length of only 30 feet. This arrangement of weirs is intended to divert one-third of the flow of the river into Mother Brook, leaving two-thirds to pass down the Charles. It is probable, however, that in times of flood more than two-thirds of the water passes down the Charles, as there is low ground at one end of this weir over which water may flow at times of extreme flood, while the banks on the sides of the weir in Mother Brook are high. The area of the watershed above these weirs is 211 square miles. Assuming that one-third of this area, or 70 square miles, is tributary to Mother Brook, there remain, of the total of 251 square miles above the Boston Manufacturing Company's dam, 181 square miles (including the area tributary to the Cambridge storage reservoirs, which at this time were, no doubt, discharging into the Charles) contributing to the estimated discharge of 3,968 cubic feet per second, or 21.9 cubic feet per second per square mile. The additional area of the watershed between the Boston Manufacturing Company's dam and Craigie bridge is 57 square miles, making a total of

238 square miles, and, assuming that the run-off of the whole watershed was at the rate of 21.9 cubic feet per second per square mile, the total discharge at Craigie bridge would have been 5,212 cubic feet per second. This estimated run-off is probably in excess of the actual, for the following reasons:—

*First.*—As stated above, probably more than two-thirds of the run-off above the weirs passed down the Charles River, and consequently the area from which it came was more than two-thirds of the total area; and, the area above the Boston Manufacturing Company's dam being more than 181 square miles, the run-off was less than 21.9 cubic feet per second per square mile.

*Second.*—The maximum rate of flow does not occur at Waltham until two or three days after the maximum rate of rainfall. The maximum rate of flow from the 57 square miles below Waltham, on the other hand, follows but a few hours after the maximum rate of rainfall, and would have passed before the crest of the main flood arrived.

In designing the sluices and other openings at the dam, it has been assumed that the waterways would be sufficient if they were capable of passing 5,700 cubic feet per second (some 10 per cent. in excess of the flood of February, 1886) without raising the basin above elevation 111 referred to a base 100 feet below Boston city base, in conjunction with continuous tides rising to elevation 113, although the basin should not be drawn down in advance below elevation 108. There is an average of about eight tides per year which rise above elevation 113, and one per year above elevation 114.

Diagram No. 1 shows the proposed openings in the dam available for flood discharge.

Diagram No. 2 shows the fluctuations in the basin at high spring, low neap and mean tides for different rates of discharge.

In case of a discharge of more than 5,700 cubic feet per second against continuous high spring tides rising to elevation 113, the basin would rise above elevation 111 unless both lock gates were open at a time when the basin and the harbor were at equilibrium and the lock used as an additional flood sluice, the lock gates, as stated under the heading of "Lock Gates," having been designed to permit of such use.



The condition which would give the highest water level in the basin would doubtless be the result of the coincidence of a large flood and a series of tides such as occurred during the storm of November, 1898, in which the steamer "Portland" was lost; these tides are characterized by both high crests and high low water, and are believed to be the most unfavorable series of tides on record for the discharge of upland flow at the dam.

As an extreme case, a study was made of the coincidence of these tides with an upland flow of 7,000 cubic feet per second. It is estimated that under these conditions the basin, if the lock gates remain closed, would reach a maximum elevation of 113.4, and would remain above elevation 113 for about four hours, and above elevation 111 for a total of about twenty-four hours. The flood assumed is one-third greater than the greatest flood on record; and a coincidence of such a flood with such a series of tides is so remote a possibility as to be hardly worthy of consideration, although, even should it occur, it appears evident that no serious damage would be done.

#### *Sluice Gates and Gate Valves.*

Much study was given to the design of sluice gates at the dam, and detail drawings were made for a wooden gate with metal fittings, and operating mechanism for hand or power operation. The question, also, of using an all-metal gate was considered, but no final conclusion had been reached at the end of the year.

The gate valves required for the pump-wells at the lock and sluices were contracted for.

#### *Power required.*

The various operations at the dam and lock, comprising drawbridge, lock gates, lock filling gates, warping machines, sluice gates, pumps at the lock and sluices, etc., require a considerable amount of power, which varies from a minimum rate of 0, when none of these operations are in progress, to a maximum rate of considerable amount when the various pumps are in operation. The power consumption is of such an intermittent character that it was early appreciated that it would be

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#### CONFIDENTIAL - SECURITY INFORMATION

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bridge in use by the Boston & Maine Railroad as a freight bridge, work was started there also.

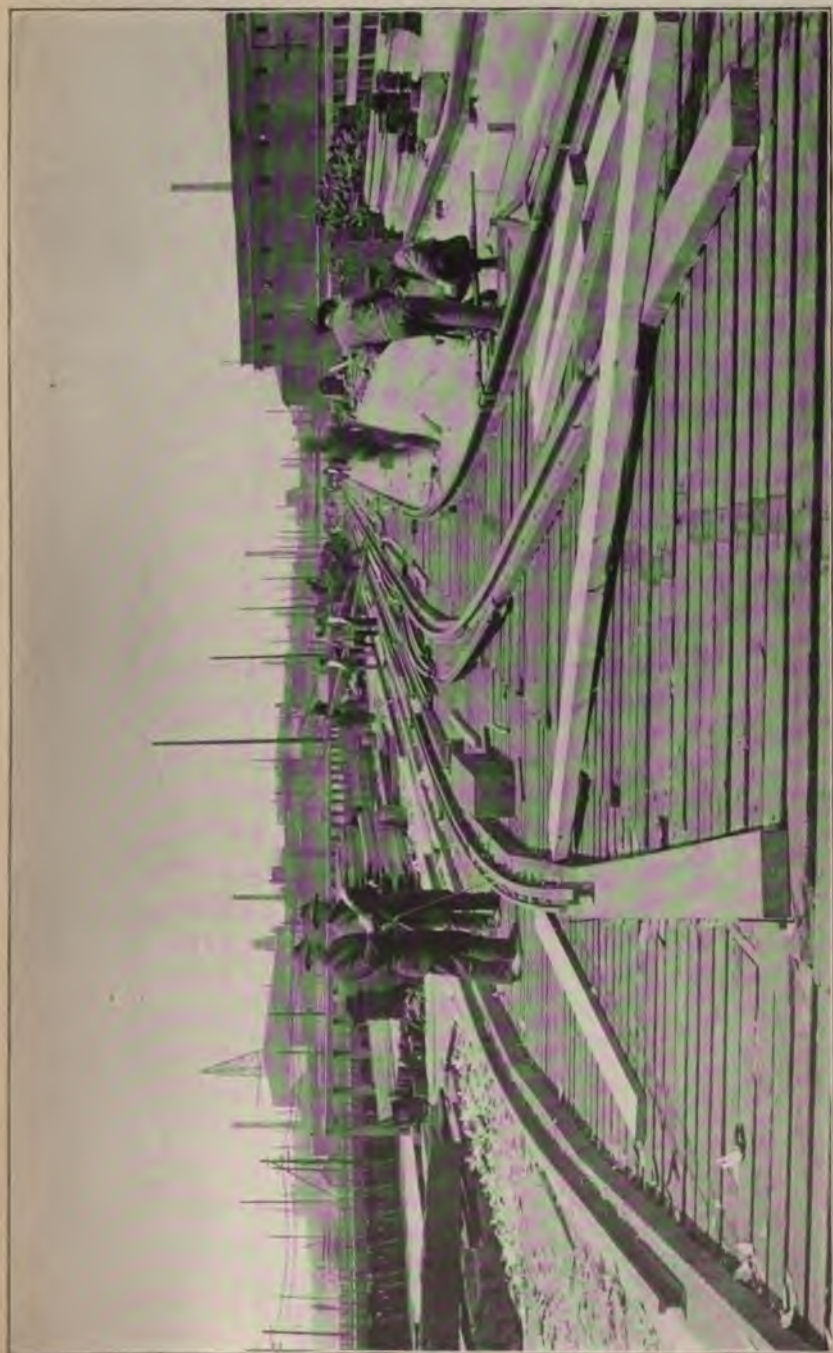
As the act establishing the Charles River Basin Commission required that the draw in the new railroad bridge should be opposite the lock, and as the draw in the temporary bridge was only some 10 feet up stream from the new railroad draw, it was necessary that the draws in these two bridges should be in line with each other. This made an angle in the channel between the draw in the temporary bridge and the draw of the existing Craigie bridge of some 30 degrees. Six dolphins were driven on the westerly side of the channel near Craigie bridge, to assist navigation passing through the draws, and the lower end of the Craigie bridge draw pier was removed for a distance of some 100 feet, to allow long barges to change their direction from one draw channel to the other.

In strengthening the railroad bridge, 8 oak piles and 27 Norway pine piles were driven in places where the old piles were too much decayed to be repaired, and 74 piles were spliced with new 14-inch by 14-inch hard pine timbers from 6 to 8 feet in length, where the tops of the piles were partially decayed, but where the main portion of the piles below high-water mark was in good condition. Where the old stringers in the railroad bridge were in an unsatisfactory condition, new stringers were substituted for them or placed adjacent to them, and one line of new 14-inch by 14-inch stringers was placed on nearly the entire length of the bridge on the Cambridge side of the draw. The ties on the railroad bridge were generally from 1 inch to 4 or 5 inches apart, and where decayed or partially decayed, were either removed and new ties substituted, or turned one-half or one-fourth over, and the tops brought to an approximately level surface. Curb stringers were set on either side, and drift-bolted through the ties. Hard pine stringers were placed for supports for the rails of the street railway, and an underflooring for the bridge was laid, consisting of spruce plank from 1½ to 3 inches in thickness. Cast-iron scuppers, having a clear opening of 2 inches by 6 inches, were set in each gutter, from 18 to 20 feet apart.

The bridge was paved with wooden blocks, in the following manner: the flooring was covered with water-proofing, con-







TEMPORARY BRIDGE — Reconstructing Old Portion of Bridge.



With one exception, the drawtenders employed on the old Craigie bridge, under the Boston and Cambridge Bridge Commission, were transferred to the temporary bridge. Until August 31 the drawtenders worked twelve hours, but since then the length of the shift has been reduced to eight hours.

#### BOSTON MARGINAL CONDUIT.

The recording gages that had been installed during the previous year in sewer overflows leading from the combined sewers tributary to the Boston main drainage system and the Metropolitan sewer, as described in the report for the year ending Sept. 30, 1904, were maintained. The results obtained by these gages are given in Table No. 1 : —

TABLE 5. — *Continued.* Average discharges of Charles River Basin, Boston, Mass., for the years ending September 30, 1904 to 1914, inclusive. (See page 33 for description of symbols.)

Month.	For Mass. Stream.				For Charles River.				For Charles River Basin.			
	No. of days of observation.	Total volume of water.	Average discharge per day of observation.	Per cent of total flow.	No. of days of observation.	Total volume of water.	Average discharge per day of observation.	Per cent of total flow.	No. of days of observation.	Total volume of water.	Average discharge per day of observation.	Per cent of total flow.
October, . . . . .	20	80.5	4.0	12.4	15	100.7	6.7	10.5	11	61.4	5.6	30.3
November, . . . . .	3	7.8	2.6	1.1	10	60.4	6.0	4.0	10	80.0	8.0	4.0
December, . . . . .	2	13.4	6.7	1.8	15	14.0	1.1	1.0	20	200.0	2.0	1.0
January, . . . . .	7	32.0	4.6	4.4	10	100.0	10.0	10.0	10	100.0	10.0	1.0
February, . . . . .	8	2.5	0.3	0.4	10	200.0	20.0	20.0	10	100.0	10.0	2.0
March, . . . . .	22	80.0	3.6	11.0	11	100.7	9.2	6.7	8	6.0	0.8	0.0
April, . . . . .	13	89.8	6.9	11.0	8	200.7	25.1	6.0	8	7.0	0.9	1.0
May, . . . . .	2	5.2	2.6	0.7	10	200.0	20.0	6.0	8	7.0	0.9	1.0
June, . . . . .	1	17.0	17.0	2.1	20	100.0	5.0	11.0	10	200.0	20.0	0.0
July, . . . . .	3	0.2	0.1	0.0	10	200.0	20.0	6.0	0	0.0	0.0	0.0
August, . . . . .	2	0.0	0.0	0.0	22	100.0	4.5	0.0	0	0.0	0.0	0.0
September, . . . . .	2	22.3	11.2	3.1	10	100.0	10.0	6.0	2	10.0	5.0	0.1
Totals, . . . . .	80	410.8	5.1	1.2	102	101.2	8.8	7.3	100	200.0	2.0	0.1



TABLE No. 1. — *Table showing Sewage Overflow into Charles River from Boston Shore for the Year ending Sept. 30, 1905, at Points indicated — Concluded.*

MONTH.	BRIMLEY STREET.				BRIMMER STREET.			
	TIDE GATES OPEN.				TIDE GATES OPEN.			
	No. of Days of Overflow.	Total Hours.	Average Hours per Day of Overflow.	Per Cent. of Total Time.	No. of Days of Overflow.	Total Hours.	Average Hours per Day of Overflow.	Per Cent. of Total Time.
October, . . . . .	11	42.6	3.9	5.7	31	243.1	7.8	32.7
November, . . . . .	10	84.5	3.5	4.8	30	259.2	8.6	36.0
December, . . . . .	13	41.4	3.2	5.6	20	140.3	7.0	18.9
January, . . . . .	11	40.0	3.6	5.4	15	40.7	2.7	5.5
February, . . . . .	8	11.1	1.4	1.7	9	40.0	4.4	6.0
March, . . . . .	9	37.6	4.2	5.0	3	12.2	4.1	1.6
April, . . . . .	5	22.0	4.4	3.1	12	82.5	6.9	11.5
May, . . . . .	6	13.5	2.3	1.8	31	236.5	9.2	34.5
June, . . . . .	14	52.2	3.7	7.3	30	275.5	9.2	38.3
July, . . . . .	15	35.6	2.4	4.8	31	238.0	7.7	32.0
August, . . . . .	19	41.3	2.2	5.6	31	253.5	8.2	34.1
September, . . . . .	25	116.0	4.6	16.1	30	226.3	7.5	31.4
Totals, . . . . .	146	487.8	3.3	5.6	273	2,097.8	7.7	24.0

The Brimmer Street gage showed a continuous overflow at low tide during October and November, and from April until the end of the year, due partly to the deposit of sand and gravel in the bottom of the sewer, and partly, as was reported after the end of the year, to a partially open blow-off valve from a water main.

A decision was reached early in the year, as the result of extended studies which were made the previous year, with the understanding that the city of Boston would proceed with the separation of sewage from storm water on the areas tributary to the Charles River, fixing the size of the Boston marginal conduit, above the connection with the basin at the upper end of the lock, with an interior area of cross-section of 41.3 square feet, the bottom of the inside masonry to be  $11\frac{1}{2}$  feet below Boston base, or some 2.1 feet below mean low tide.

Various designs for overflows from the conduit into the basin were considered, and a final decision adopted. Much study was given to the economical design of the masonry section, and extended studies were made of the rainfall, run-off, etc., of sewers tributary to this conduit from the dam to the Fens.

Contract plans were drawn for the section of the Boston marginal conduit extending from the dam to the southerly side of Cambridge Street, located almost entirely in the Charles-bank. In connection with this work 13 borings were taken, to depths of from 20 to 48 feet, with a total depth of 530.4 feet.

A contract was made for the portion of the conduit between the dam and the southerly side of Cambridge Street. This conduit is of concrete, having for inside dimensions a height of 7 feet  $8\frac{1}{4}$  inches, and a width of 6 feet 4 inches. The first 422 feet in length are built on a gravel and clay bottom, without piles. The remainder of the conduit, so far as constructed at the end of the year, is on piles. A 10-inch underdrain has been laid about a foot below the invert. One-half-inch twisted steel rods, turned up at the ends for about a foot, laid some  $4\frac{1}{2}$  inches above the bottom, and  $\frac{3}{4}$ -inch rods laid 3 inches below the top, have been built in the concrete of the invert, both rods usually being spaced 12 inches on centers. The piles used are spruce, 10 inches in diameter at the butt and 6 inches at the tip, and were driven 2 feet apart on centers under the side walls, and 4 feet apart under the center of the conduit.

The driving of piles during the day interfered so much with the use of a cableway for excavating and backfilling that the contractor was permitted to drive piles at night, all piles being driven in that way since August 31, except on Saturday afternoons. Delays occasioned by old sea-walls, bulkheads and other obstructions, and the large quantity of water to be taken care of, caused the work to progress more slowly than required by the contract. A brick bulkhead, 12 inches thick, was built at the lower end of the conduit on September 1, and the outside face covered with a coat of cement plaster, to keep out the water. In places where the conduit passed through old sea-walls and rock fills, voids were left back of the sheeting. These voids were filled as quickly as possible, either with sand or a cement grout.

At the request of the officials of the park department of the city of Boston, the construction of that portion of the conduit through the Women's Gymnasium at the southerly end of the Charlesbank was put off until as late in the fall as possible, in order to not interfere with the use of this portion of the park during the summer months, when the schools are closed. In order, however, to complete the work at Cambridge Street before traffic should be diverted to the new Cambridge bridge, the contractor started a force on that end of the work September 20. Unexpected difficulties were encountered at this point. The excavation was partially through an old rock fill, which allowed tide water from the river to enter the trench freely. Trouble was also experienced with the pumps.

The conduit was built largely under the sidewalk next Charles Street, from Poplar Street to Fruit Street. The park department of the city of Boston planned to relocate the sidewalk, after the construction of the conduit, by moving it nearer to the street; and, as the conduit would then come in the park area, the department desired to have the conduit trench surfaced with loam to a depth of 18 inches. It was agreed that the Charles River Basin Commission should furnish 12 inches of this loam, and would not be required to replace the previously existing brick sidewalk. An agreement was therefore made with the contractor for furnishing the loam, as extra work under the contract.



## DREDGING IN THE BASIN.

Preliminary studies were made for dredging channels of various widths and depths at the upper end of the basin, and for disposing of the material in filling the shallow arms and pools adjacent to the river. This work is necessary in order to provide a sufficient depth of water at the upper end of the basin to render it attractive and to permit its use for pleasure purposes. It will also assist in the destruction of malarial mosquitoes by destroying their breeding places. Further surveys will be required before reaching definite conclusions.

Soundings were made in the lower basin, where dredging is necessary to give the required depth of water for navigation purposes.

## BROAD AND LECHMERE CANALS.

Soundings were made in Broad Canal for a length of 3,475 feet, the width of the canal varying from 75 to 125 feet; and in Lechmere Canal for a length of 2,043 feet, the canal varying in width from 100 to 127 feet. These soundings were taken not more than 10 feet apart, on cross-section lines 25 feet apart.

## LAND TAKINGS.

A taking plan was made of the land of George O. Proctor at the westerly end of the dam. This property is bounded by Commercial Avenue, Bridge Street, the river and Lechmere Canal.

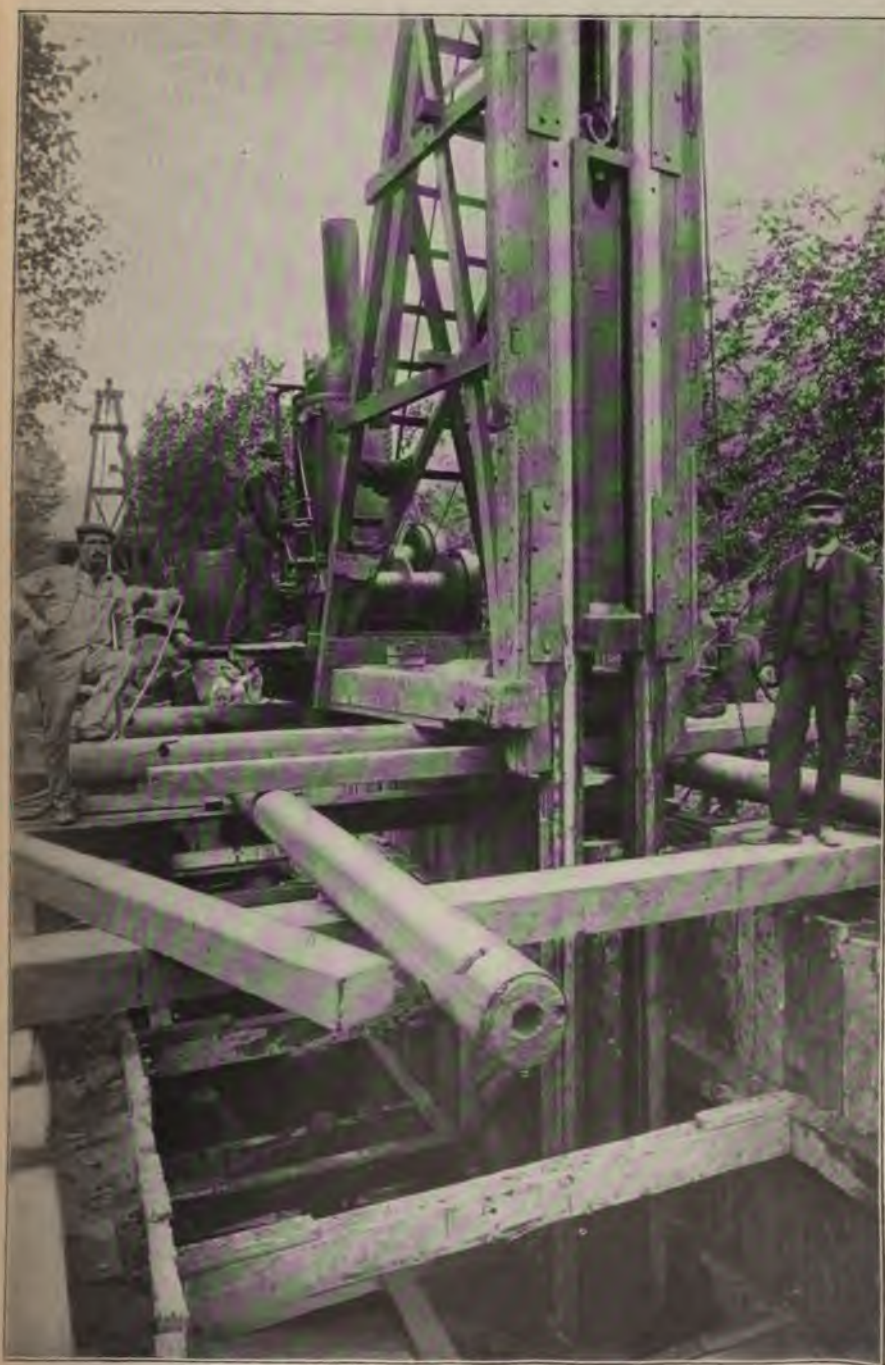
A taking plan was also made of property claimed by the heirs of Caroline M. McGlenen near the Boston end of Craigie bridge.

## SUMMARY OF BORINGS.

The following is a summary of the borings made in the basin and the canals and for the Boston marginal conduit:—

	Number.	Total Depth (Feet).
Made during the year, . . . . .	13	530.4
Made previous to Oct. 1, 1904, . . . . .	150	4,535.3
Total, . . . . .	163	5,065.7





BOSTON MARGINAL CONDUIT — Driving Piles.



## SUMMARY OF SOUNDINGS.

The work of taking soundings, which had been started only a week previous to the end of the time covered by the last annual report, was continued during the fall as long as the weather permitted, and was resumed in the early spring. The area covered by the soundings amounted to 45.34 acres, which, added to the area sounded during the previous year, makes a total of 47.84 acres. The method of making these soundings was described in the report of the chief engineer for the year ending Sept. 30, 1904.

## UPLAND FLOW OF THE CHARLES RIVER.

Careful studies of upland flows and the discharge of the Charles River at the dam were made.

A recording gage, showing the depth of water flowing over the dam at the Waltham Bleachery, was maintained, and weekly current meter observations were taken of the flow in the canal past the Bleachery dam. Although one heavy rainfall was recorded on September 3 and 4, amounting to some 4½ inches, it did not increase very materially the flow on the lower portion of the river, and neither the maximum nor the minimum flow of this year approaches the record of the previous year.

Table No. 2 shows the estimated average flow of the Charles River at Waltham for weekly periods during the year ending Sept. 30, 1905. The area of the watershed above "The Bleachery" is taken to be 169 square miles; this excludes 70 square miles assumed to be tributary to Mother Brook and 24 square miles tributary to the Cambridge reservoirs. Whenever these reservoirs overflowed into the Charles, the amount, as furnished by Mr. L. M. Hastings, city engineer of Cambridge, has been deducted from the total discharge measured at "The Bleachery."

Table No. 3 shows the number of days during the year ending Sept. 30, 1905, when the upland flow of the Charles River at Craigie bridge, estimated from the records kept by the Charles River Basin Commission at the Waltham Bleachery, was more than 500 cubic feet per second for twenty-four hours.



TRAFFIC THROUGH DRAW OF CRAIGIE BRIDGE AND OF  
TEMPORARY BRIDGE.

A record was kept of the traffic through the draw of Craigie bridge until the temporary bridge was completed, when the records were transferred to the latter bridge. This record gives the tonnage, draft and time of passage of vessels of different kinds. Some of the results of the records obtained are shown by the following diagrams:—

Diagram No. 4 shows weekly totals of cargoes, in tons, not including the material furnished for the Charles River dam, passing Craigie bridge and the temporary bridge for the year ending Sept. 30, 1905.

Diagram No. 5 shows the monthly totals of cargoes, in tons, not including the material furnished for the Charles River dam, passing Craigie bridge since Sept. 30, 1899. Except for a slight increase during the current year, this diagram indicates quite a regular decrease in the amount of tonnage each year for the last six years, with the exception of the year 1900-01, when the construction of the foundations for the piers of the new Cambridge bridge caused a large increase in the traffic.

Diagram No. 6 shows the yearly number of vessels passing Craigie bridge since Sept. 30, 1885, and the number of times the draw has been opened per year since Sept. 30, 1871, the only complete years covered by existing records.

The winter of 1904-05 was severe, ice forming in the river before Christmas and continuing until the latter part of February.

## MISCELLANEOUS ENGINEERING WORK.

Eighty finished plans were prepared during the year, besides numerous studies and designs. A number of working drawings for the dam and lock, also, were in a partially completed condition at the end of the year. One hundred and seventy-three plans were indexed and filed, which, with previous plans, make a total of 435.

One hundred and twelve photographs were taken by Mr. Luther H. Shattuck.

## STORAGE SHED.

A storage shed, 64 feet long by 29 feet wide, was built at the corner of Charles and Leverett streets, to take care of the



twisted steel rods which are to be used in the bottom of the lock and of the Boston marginal conduit. On one side of this is a lime box, some 33 feet long by 6 feet wide by 18 inches deep, in which the rods are kept in air-slacked lime, after being bent. For use in connection with these rods a hydraulic bending machine was installed in the shed. This bending machine consists of a hydraulic jack, with a cylinder some 6 inches in diameter, to each end of which is connected a 1-inch pipe controlled by 3-way cocks each side of the delivery pipe from the force pump. A pressure of 900 pounds per square inch has been obtained from this machine, and it requires less than 600 pounds pressure to bend a rod  $1\frac{1}{8}$  inches in diameter. A Watson-Stillman hydraulic shear was also installed in the storage shed, and is used to cut the twisted steel rods into the required lengths.

#### CONTRACTS

Nineteen contracts were let during the year. The preparation of the various contract plans and specifications, estimates, supervision of the work, etc., occupied a considerable portion of the time of the engineering force. A detailed statement of the contracts made during the year is given in Appendix B.

Following are additional descriptions of some of these contracts, except so far as the work done under them has already been described under the headings of "Dam and Lock," "Temporary Bridge and Approaches," and "Boston Marginal Conduit."

*Contract No. 1, Holbrook, Cabot & Rollins Corporation.—*

*Dam and Lock in the Charles River, Boston and Cambridge.*

On Jan. 14, 1905, a contract was made with the Holbrook, Cabot & Rollins Corporation for the construction of the dam and lock. The amount of this contract, on the basis of award, is \$801,607.50.

The contract provides for the following work:—

The main portion of the dam is to be constructed of earth filling between masonry retaining walls, supported on pile foundations. Within the coffer-dam to be built at the Boston end are to be constructed the lock, a portion of the Boston marginal conduit, with gate-chambers, connections to the basin

and other structures. Within the coffer-dam to be built at the Cambridge end are to be constructed a portion of the Cambridge marginal conduit, and sluices for the purpose of discharging the flow of the river through the dam, the central one of which, with its top at a higher level than the others, will serve also as a lock for small boats. The sluice next the Cambridge side will be connected with the marginal conduit. Gate-chambers and other structures will be connected with the masonry of the sluices. The structures within the coffer-dams will be mainly of concrete masonry on pile foundations. From the lock to the sluices on the Cambridge side there is to be constructed a so-called shut-off dam, for the purpose of arresting the tidal flow. Excavations by dredging will be required in the Broad and Lechmere canals, in the basin and in the vicinity of the outlets of the sluices and marginal conduits. Excavation at the dam and lock, by dredging and other methods, will be required at the sites of the retaining walls and shut-off dam, and from the area enclosed by the coffer-dams. The material to be obtained from the above excavation will be used at the dam unless the contractor is required to deposit some of the material between the Cambridge bridge and Fairfield Street, on the Boston side of the basin, or in the basin below the Cambridge bridge. The earth from the above excavation not being sufficient to complete the earth portion of the dam, additional filling is to be obtained from other sources. Coarse gravel and riprap will be required at the shut-off dam and at the ends of the lock and sluices. The Leverett Street, Chambers Street and Bridge Street sewers are to be connected with the marginal conduits.

The following table gives a summary of the principal quantities and prices : —

ITEMS.	Quantities.	Maximum Prices.	Minimum Prices.
Coffer-dam at the Boston end, . . .	-	\$70,000 00	\$70,000 00
Coffer-dam at the Cambridge end, . . .	-	27,000 00	27,000 00
Earth excavation, . . . . .	730,000 cu. yds.	45	34
Coarse gravel, . . . . .	7,000 cu. yds.	75	75



ITEMS.	Quantities.	Maximum Prices.	Minimum Prices.
Broken stone or screened gravel, . . .	5,700 cu. yds.	\$1 50	\$1 50
Riprap, . . . . .	9,700 cu. yds.	1 50	1 50
Round piles in place, . . . . .	468,500 lin. ft.	30	14
Spruce lumber in place, . . . . .	540 M. ft. B. M.	50 00	35 00
Concrete masonry, . . . . .	41,000 cu. yds.	6 50	4 50
Granolithic surfacing, . . . . .	1,800 sq. yds.	1 00	1 00
Ashlar masonry, . . . . .	2,710 cu. yds.	20 25	18 00
Face dressing, . . . . .	20,000 sq. ft.	80	50
Iron and other metal work to be placed, .	500 tons	25 00	25 00
Furnishing and laying vitrified pipe, . .	5,000 lin. ft.	60	15

During the months of January and February the contractor was gradually accumulating the plant to be used in the work, consisting of engines, boilers, derricks, pumps, etc., and work was started on the main contract March 1, by removing the iron fence along the sea-wall at the northeasterly end of the Charlesbank. Piles were driven for the foundation of a storage bin for sand and gravel to be used for the concrete, and some of the posts and framing were set in place.

The first sheeting for the coffer-dam on the Boston side was driven on March 21. At 7 A.M., on July 5, the work of tearing down the old Craigie bridge was started. The dredging for the foundation for the lock was begun on April 27. The timber portion of the coffer-dam on the Boston side was completed on September 29.

The first piles in the temporary bridge were driven on March 2. The Boston & Maine Railroad began sending trains over its new bridge on March 27. The work of removing piles in the old Boston & Maine drawbridge was begun on March 31.

The total value of the work performed, as shown by the September estimate, was \$119,917.79, the principal items of which were as follows:—

Coffer-dam at the Boston end, . . . . .	46 per cent. completed.
Coffer-dam at the Cambridge end, . . . . .	4.5 per cent. completed.
Earth excavation, . . . . .	113,115 cu. yds.
Round piles in place (exclusive of coffer-dams), . . . . .	18,170 lin. ft.

*Contract No. 2, United States Wood Preserving Company. —  
Wooden Block Paving for Temporary Bridge, Boston and  
Cambridge.*

On March 23, 1905, a contract was made with the United States Wood Preserving Company for furnishing and laying the wooden block paving for the temporary bridge. The amount of this contract, on the basis of award, is \$11,700.

The contract called for paving the temporary bridge with creosote-resinate wood block pavement, with a maintenance guarantee for four years.

The wood blocks were received and the unloading of a vessel was started on May 8, and completed May 11. Laying tar paper for the waterproofing was started May 27, and the first of the wood blocks were laid on June 2. The laying of the wood blocks was completed on Sunday, June 18. The regular traffic was not turned over the bridge until July 2.

Owing to the unsatisfactory condition of the roadway, the amount allowed on this contract at the end of the year was \$4,782.52.

*Contract No. 3, James Driscoll & Son. — Section 2 of the  
Boston Marginal Conduit, Boston.*

On June 13, 1905, a contract was made with James Driscoll & Son for the construction of the Boston marginal conduit, between the dam and the southerly side of Cambridge Street. The amount of this contract, on the basis of award, is \$50,600.

The contract calls for the construction of the main conduit and of an overflow conduit extending from the main conduit to the Charlesbank wall, a short distance north of Cambridge Street. The contract provides for piles where necessary, for reinforcing the concrete with steel rods furnished by the Commission, and for the temporary crossings of the overflows from the sewers at Fruit Street and Cambridge Street. The principal items of the preliminary estimate were: —

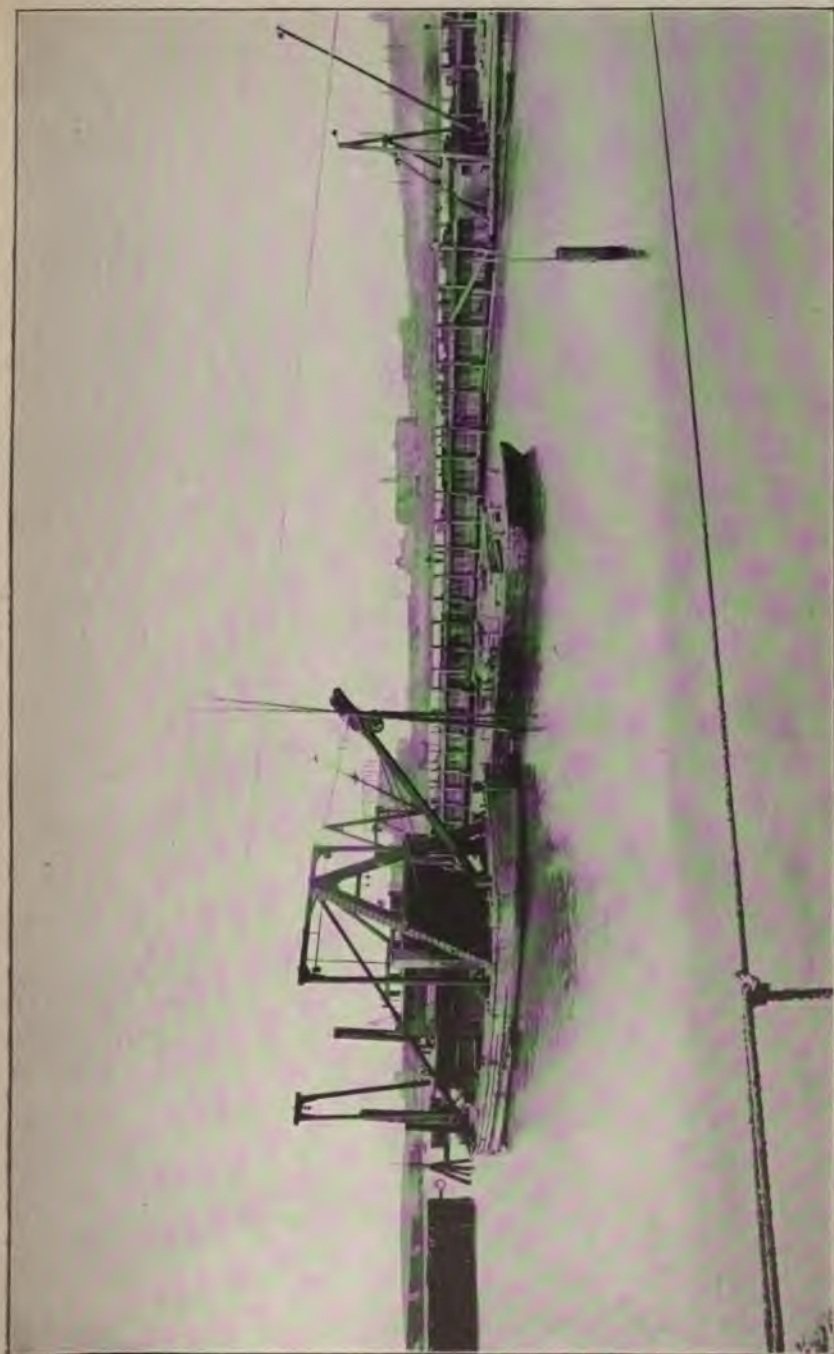
Earth excavation and refill (main conduit),	. . .	1,800 lin. ft.
Earth excavation and refill (overflow conduit),	. . .	175 lin. ft.
Piles,	. . . . .	62,000 lin. ft.
Underdrain,	. . . . .	2,000 lin. ft.





DAM AND LOCK — Guide Piles for Cofferdam at Lock.

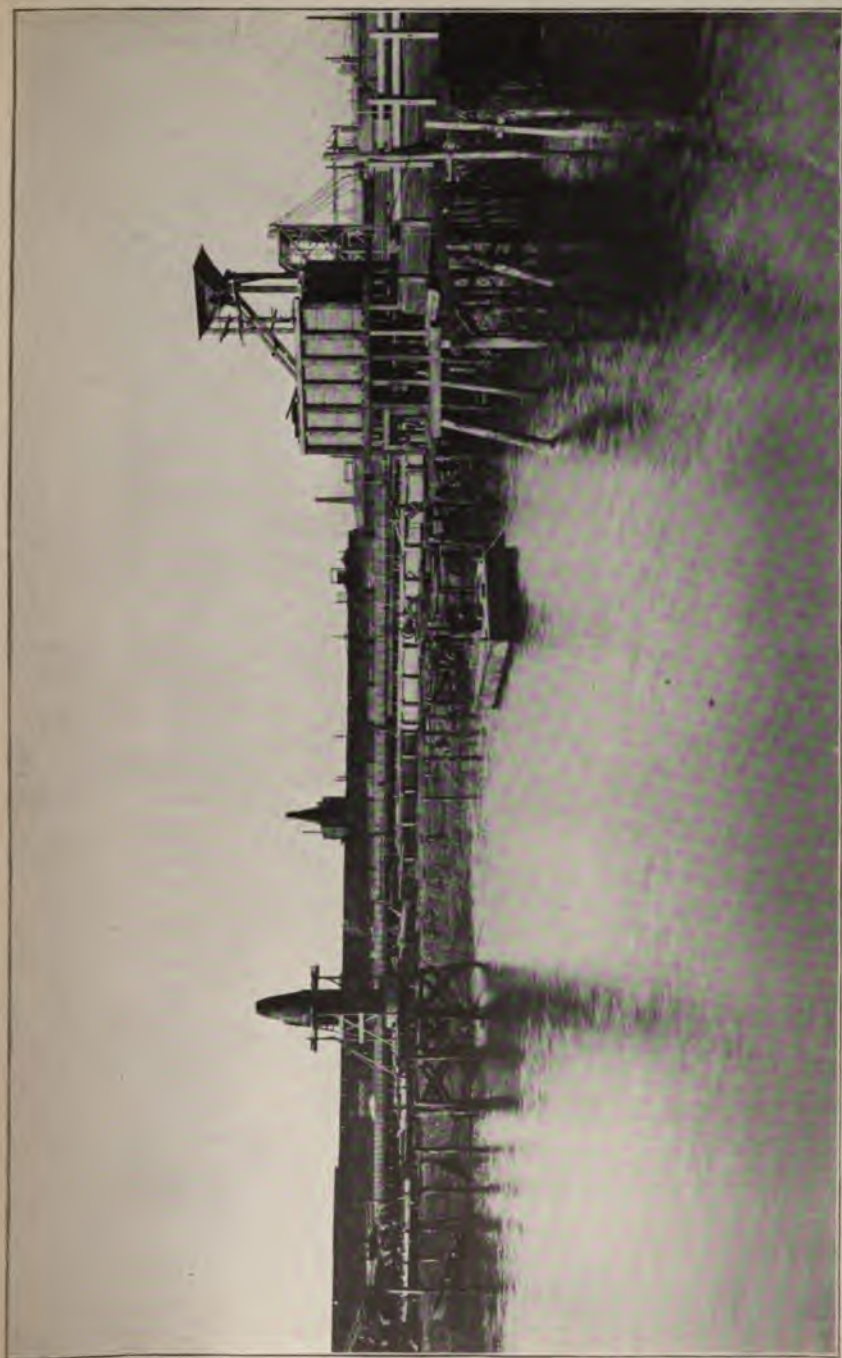




DAM AND LOCK — Westerly Side of Coffe-dam and Dredging at Lock.







DAM AND LOCK — Coffe-dam, Boiler and Storage Bin at Lock.





DAM AND LOCK — Removing Craigie Bridge.





Concrete masonry, . . . . .	2,700 cu. yds.
Placing iron and other metal work, . . . . .	45 tons.
Sheeting left in place, . . . . .	70 M. ft. B. M.

Work was started under this contract on June 21. A stiff-leg derrick was delivered on June 23, and on June 26 excavation for a pump-well began. A Carson-Lidgerwood cableway, about 300 feet long between towers, was put in operation July 8, and continued on the work until the end of the year. The first section of the concrete invert was laid July 11, three weeks after starting work. A Smith concrete mixer was delivered and put in operation July 26. Lehigh and Whitehall cements have been used for the concrete. Pile-driving was begun August 12.

The total value of the work performed, as shown by the September estimate, was \$15,261.69, the principal items of which were as follows:—

Earth excavation and refill (main conduit), . . . . .	668.9 lin. ft.
Piles, . . . . .	6,928.8 lin. ft.
Underdrain, . . . . .	672.0 lin. ft.
Concrete masonry, . . . . .	818.1 cu. yds.
Placing iron and other metal work, . . . . .	8.0 tons.
Sheeting left in place, . . . . .	19.0 M. ft. B. M.

*Contract No. 4, Camden Iron Works.—Cast-iron Pipes and Special Castings, Boston and Cambridge.*

On July 18, 1905, a contract was made with the Camden Iron Works for a portion of the cast-iron pipes and special castings to be embedded in and attached to the masonry in connection with the dam and lock and the Boston marginal conduit. The amount of the contract, on the basis of award, is \$5,640.75.

The contract includes the cast-iron pipes and special castings for suction pipes and discharge pipes leading to pump-wells at the lock and sluices, the conduit under the lock, outlets from marginal conduits and overflows, and other purposes. The engineer's estimate of quantities is as follows:—

Straight pipe, of sizes varying from 6-inch to 60-inch, . . . . .	110.0 tons.
Standard special castings, . . . . .	15.1 tons.
Special castings, . . . . .	22.2 tons.

Considerable progress had been made on this contract prior to the end of the year, but no pipe had been received or payments made thereon.

*Contract No. 5, Henry R. Worthington. — Furnishing and erecting Pumps, Boston and Cambridge.*

On Sept. 30, 1905, a contract was made with Henry R. Worthington for furnishing and erecting pumps, the amount of the contract being \$9,533.

The contract calls for furnishing and erecting three pumps, with motors, suction pipes, foot valves, controllers and appurtenances, for the purpose of emptying the lock, lock gate recesses, and sluices at the dam, one pump having a capacity of 13,000 gallons per minute, another 5,000 gallons per minute, and the third 1,200 gallons per minute. The contract also provides that the contractor shall keep the pumps in repair for two years after they are erected and tested.

*Contract No. 6, Gibby Foundry Company. — Furnishing Castings and Other Metal, Boston and Cambridge.*

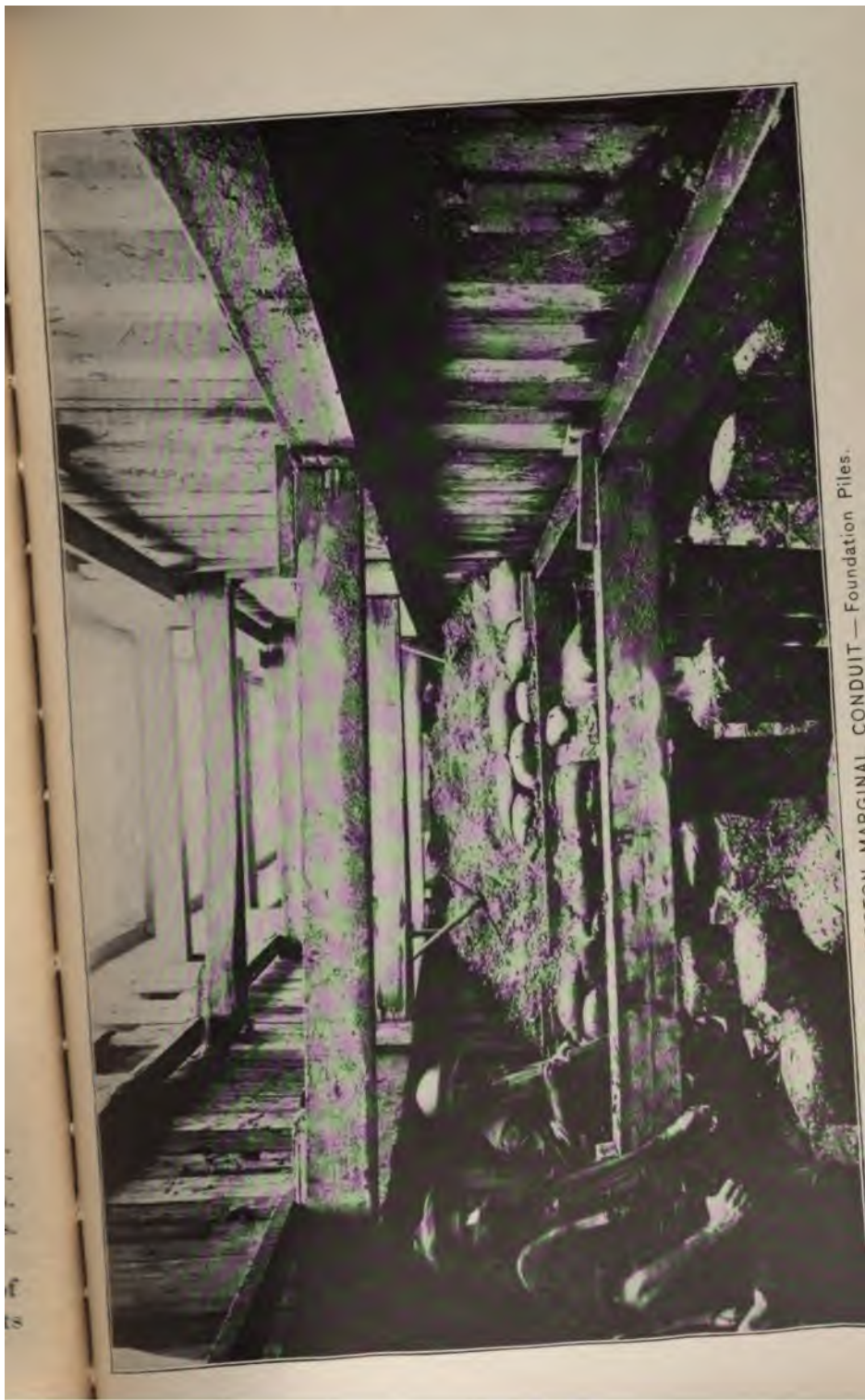
On July 27, 1905, a contract was made with the Gibby Foundry Company for castings and other metal required in connection with the dam and lock and the Boston marginal conduit. The amount of the contract, on the basis of award, is \$6,013.74.

This contract covers the greater part of the special castings required at the lock and the lower portion of the Boston marginal conduit. The principal items of the preliminary estimate were : —

Unfinished iron castings, . . . . .	27,320 pounds.
Finished iron castings, . . . . .	82,350 pounds.
Finished steel castings, . . . . .	5,260 pounds.
Rods, bolts, etc., . . . . .	5,270 pounds.

At the end of the year some 3 per cent. of the total value of the contract had been delivered at the dam, but no payments had been made to the contractor.





SECTIONAL MARGINAL CONDUIT — Foundation Piles.







BOSTON MARGINAL CONDUIT — View at Fruit Street showing Cableway and Pile-driver.



*Operating Machinery for Temporary Draw.*

In addition to the contracts enumerated in Appendix B, Mr. H. J. Shaw erected the machinery of the temporary draw, under an arrangement by which he furnished the machine labor at \$0.50 per hour, blacksmith labor (including blacksmith and helper) at \$0.80 per hour, and the cast iron at \$0.005 per pound, in addition to his cost price. The other machinery, trunnions and weights for operating the draw, so far as furnished by him, were at cost. The amount paid Mr. Shaw under this arrangement was \$3,785.13.

Respectfully submitted,

HIRAM A. MILLER,

*Chief Engineer.*

BOSTON, Dec. 26, 1906.





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## APPENDIX.

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## APPENDIX A.

CHAPTER 465 OF THE ACTS OF 1903, AS AMENDED BY CHAPTER 65  
OF THE ACTS OF 1905.

AN ACT TO AUTHORIZE THE CONSTRUCTION OF A DAM  
ACROSS THE CHARLES RIVER BETWEEN THE CITIES  
OF BOSTON AND CAMBRIDGE.

*Be it enacted, etc., as follows:*

SECTION 1. The governor of the Commonwealth, with the advice and consent of the council, shall appoint three commissioners, residents of the metropolitan parks district, who shall constitute the Charles river basin commission, hereinafter called the commission, and who shall be sworn before entering upon the duties of their office. One commissioner shall be designated by the governor as chairman, and two commissioners shall constitute a quorum. The term of office shall be three years, and all vacancies shall be filled by the governor, with the advice and consent of the council. Any commissioner may be removed by the governor, with the advice and consent of the council, for such cause as he shall deem sufficient and shall assign in the order of removal. Each commissioner shall receive an annual salary of such amount as the governor and council shall determine.

Charles river  
basin commis-  
sion, appoint-  
ment, term,  
etc.

SECTION 2. The commission may appoint a secretary, engineers and assistants, shall keep accurate accounts of its expenditures, and shall make an annual report of its doings, including an abstract of its accounts, to the governor and council. The commission whenever the Commonwealth has been authorized by the United States to build a dam and lock under the provisions of this act, shall proceed to do the work herein required of it, and shall in the meantime make examinations and plans therefor.

Compensa-  
tion.

Powers and  
duties.





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Powers and  
duties.

Dam to be  
constructed  
across Charles  
river, etc.

SECTION 3. The commission shall construct across Charles river between the cities of Boston and Cambridge, a dam, at least sufficiently high to hold back all tides and to maintain in the basin above the dam a substantially permanent water level not less than eight feet above Boston base. The dam shall occupy substantially the site of the present Craigie bridge, which shall be removed by the commission. *The commission may construct or otherwise provide a temporary highway bridge and approaches thereto for the use of teams and pedestrians during the construction of the dam.* The dam shall be not less than one hundred feet in width at said water level and a part thereof shall be a highway and the remainder shall be a highway, or a park or parkway, as the commission shall determine. The dam shall be furnished with a lock not less than three hundred and fifty feet in length between the gates, forty feet in width and thirteen feet in depth below Boston base, and shall be built with a suitable drawbridge or drawbridges, wasteways and other appliances. The part of the dam used as a highway shall be maintained and operated in the same manner as the Cambridge bridge, and under the laws now or hereafter in force relating to said bridge.

Navigable  
channels to be  
dredged.

SECTION 4. The commission shall dredge navigable channels in the basin from the lock to the wharves between the dam and Cambridge bridge, to Broad canal and to Lechmere canal, the channel to be not less than one hundred feet in width and eighteen feet in depth; shall dredge Broad canal to such depths as will afford to and at the wharves thereon not less than seventeen feet of water up to the Third Street draw, not less than thirteen feet of water from the Third Street draw to the Sixth Street draw, and not less than eleven feet of water from the Sixth Street draw to the railroad draw, and not less than nine feet of water for one hundred and twenty-five feet above the railroad draw; shall dredge Lechmere canal to such depths as will afford to and at the wharves thereon not less than seventeen feet of water up to and including Sawyer's lumber wharf,



and not less than thirteen feet of water from said wharf up to the head of the canal at Bent street; all depths aforesaid to be measured from the water level to be maintained in the basin.

The commission shall do all such dredging and all strengthening of the walls of the canals and of the basin where dredging is done by the driving of prime oak piles two feet on centres along the front of said wharves or walls, and all removing and relocating of pipes and conduits made necessary by such dredging, so that vessels requiring a depth of water not exceeding the respective depths above prescribed can lie alongside of, and in contact with, the wharves; and this work shall be done in such manner as to cause the least possible inconvenience to abutters, and shall be finished on or before the completion of the dam; and after the walls or wharves have been so strengthened, all repairs on or rebuilding of the walls and wharves shall be done by the abutters.

Manner of dredging, etc.

The commission shall do such dredging in the basin outside of the channels aforesaid as may be necessary for the removal of sewage, sludge or any offensive deposit; shall do such other dredging as it shall deem proper, and shall take all proper measures for the destruction of malarial mosquitoes in the basin and its vicinity.

Certain other dredging to be done, etc.

SECTION 5. The commission, before the completion of the dam, shall construct marginal conduits on the north side of the basin from the outlet of the overflow channel in Binney street to a point below the dam, and on the south side of the basin from the present outlet of the Back Bay Fens to a point below the dam, and may construct an extension thereof toward, or to, St. Mary street, the conduits to be used to receive and conduct below the dam the overflow from sewers and the surface drainage and other refuse matter which would otherwise pass into the basin.

Marginal conduits to be constructed, etc.

SECTION 6. The commission, for the purpose of carrying out the provisions of the preceding sections, may from time to time take in fee or otherwise, by

Certain lands, etc., may be taken, etc.

purchase or otherwise, for the Commonwealth, or the city of Boston or the city of Cambridge, as the commission shall determine, lands, flats and lands covered by tide-water on Charles river, by filing in the registry of deeds for the county and district in which the lands or flats are situated a description thereof, sufficiently accurate for identification, signed by a majority of the commissioners; and any person whose property is so taken may have compensation therefor as determined by agreement with the commission, and if they cannot agree the compensation may be determined by a jury in the superior court for the county where the property is situated under the same provisions of law, so far as they are applicable, which apply in determining the value of lands taken for highways under chapter forty-eight of the Revised Laws, upon petition therefor by the commission, or by such person, filed in the clerk's office of said court against the Commonwealth or the city for which the lands or flats are taken within one year after the taking, and costs shall be taxed and execution issued as in civil cases.

The metropolitan park commission to have exclusive control of dam, etc.

May make rules and regulations, etc.

SECTION 7. The metropolitan park commission, when the work provided for in the preceding sections is finished, shall, subject to the powers vested by law in the state board of health, have exclusive control of the dam and lock and of the basin and river between the dam and the city of Waltham, as a part of the metropolitan parks system, and of all poles, wires and other structures placed or to be placed on, across, over or in any part of said basin, dam or lock, and of the placing thereof, except the part of the dam used as a highway and the bridges and other structures erected by any city or town within its limits and upon its own lands; may make reasonable rules and regulations, not impairing freight traffic, for the care, maintenance, protection and policing of the basin; and throughout the year shall operate the lock without charge, maintain the lock, channels and canals aforesaid at the depths aforesaid, and clear of obstructions caused by



natural shoaling or incident to the building of the dam, and maintain the water in the basin at such level and the lock, channels and canals sufficiently clear of obstructions by ice so that any vessel ready to pass through the lock, and requiring no more depth of water than aforesaid, can pass through to the wharves aforesaid.

In the event of an emergency, requiring the temporary reduction of such level, notice thereof shall be given to the occupants of said wharves, and such reduction shall not be lower nor continue longer than the emergency requires. Said metropolitan park commission may order the removal of all direct sewage or factory waste as a common nuisance from the river and its tributaries below the city of Waltham; and no sewer, drain, overflow or other outlet for factory or house drainage shall hereafter be connected with the basin below said city without the approval of the metropolitan park commission.

Notice to be given in case of emergency requiring temporary reduction of level, etc.

Removal of direct sewage or factory waste may be ordered, etc.

SECTION 8. The Commonwealth shall in the first instance pay all expenses incurred in carrying out the provisions of the preceding sections, and the same shall, except as provided in the following section, constitute part of the cost of construction and maintenance of the metropolitan parks system; and in addition to the amounts heretofore authorized for such construction the treasurer and receiver-general shall, from time to time, as authorized by the governor and council, issue notes, bonds or scrip, in the name and behalf of the Commonwealth, entitled Charles River Basin Loan, to the amount which the commission may deem necessary for the expenses incurred under the first six sections of this act; and all acts and parts of acts relative to loans for such construction and providing for their payment shall, so far as they may be applicable and not inconsistent herewith, apply to such notes, bonds and scrip and to their payment.

Payment of expenses.

Charles River Basin Loan.

SECTION 9. The commissioners next appointed under the provisions of chapter four hundred and nineteen of the acts of the year eighteen hundred and ninety-

Apportionment of expenses, etc.

nine, and amendments thereof, in apportioning the expenses of maintaining the metropolitan parks system shall include as part thereof the expense of maintenance incurred under the preceding sections of this act; shall also determine, as they shall deem just and equitable, what portion of the total amount expended for construction under sections three, four, five and six of this act shall be apportioned to the cities of Boston and Cambridge as the cost of the removal of Craigie bridge and the construction of a suitable bridge in place thereof, and the remainder shall be considered and treated as part of the cost of construction of the metropolitan park system. The treasurer and receiver-general shall determine the payments to be made each year by said cities, one half by each, to meet the interest and sinking fund requirements for the amounts apportioned to them as the cost of such bridge, and the same shall be paid by each city into the treasury of the Commonwealth as part of its state tax.

City of Boston  
to do certain  
dredging,  
construct con-  
duits, sewer,  
etc.

SECTION 10. The city of Boston, by such officer or officers as the mayor may designate, shall forthwith after the passage of this act, do such dredging in the Back Bay Fens as the board of health of said city may require, shall construct a conduit between Huntington avenue and Charles river, to form an outlet into Charles river for the commissioners' channel of Stony brook, shall reconstruct the present connections between the river and the Fens so as to allow free access of water from the river into the streams and ponds in the Fens and thence into the river, and shall construct a sewer in the rear of the houses on the north side of Beacon street between Otter and Hereford streets. Such officer or officers may construct a conduit between Green street and Forest Hills and may construct or rebuild within five years one or more conduits for Stony brook between the westerly side of Elmwood street and the Fens: *provided, however*, that the expense of such conduits between Green street and Forest Hills and between Elmwood street and the Fens shall be paid for

Proviso.



out of the annual appropriation for sewer construction under the provisions of chapter four hundred and twenty-six of the acts of the year eighteen hundred and ninety-seven and acts in amendment thereof or in addition thereto.

SECTION 11. The board of park commissioners of Boston may, with the approval of the mayor, build a wall or embankment on the Boston side of Charles river beginning at a point in the southwest corner of the stone wall of the Charlesbank, thence running southerly by a straight or curved line to a point in Charles river not more than three hundred feet distant westerly from the harbor commissioners' line, measuring on a line perpendicular to the said commissioners' line at its intersection with the southerly line of Mount Vernon street, but in no place more than three hundred feet westerly from said commissioners' line; thence continuing southerly and westerly by a curved line to a point one hundred feet or less from the wall in the rear of Beacon street; thence by a line substantially parallel with said wall to the easterly line of the Back Bay Fens, extended to intersect said parallel line.

Wall or embankment may be built on Boston side of Charles river.

SECTION 12. The board of park commissioners of said city may take, in fee or otherwise, by purchase or otherwise, for said city, for the purpose of a public park such lands, flats and lands covered by tide-water between Charles, Brimmer and Back streets and the line of the wall or embankment aforesaid, as the mayor shall approve, by filing in the registry of deeds for the county of Suffolk a description thereof sufficiently accurate for identification, signed by a majority of the commissioners, and shall construct a public park on the lands so taken; and any person whose property is so taken may have compensation therefor as determined by agreement with the board, and if they cannot agree the amount thereof may be determined by a jury in the superior court for the county of Suffolk, under the same provisions of law, so far as they may be applicable, which apply in determining the value of lands taken

Certain lands, flats, etc., may be taken for a public park.

for highways under chapter forty-eight of the Revised Laws, upon petition therefor by the board, or by such person, filed in the clerk's office of said court against said city within one year after the taking, and costs shall be taxed and execution issued as in civil cases.

City of Boston  
to pay certain  
expenses, etc.

SECTION 13. The city of Boston shall pay the expenses incurred under sections ten, eleven and twelve of this act, except as otherwise provided in section ten of this act; and to meet said expenses the city treasurer of the city shall, from time to time, on the request of the mayor, issue and sell bonds of the city to an amount not exceeding eight hundred thousand dollars, and the bonds so issued shall not be reckoned in determining the legal limit of indebtedness of the city.

The Boston  
and Maine  
Railroad to  
remove certain  
structures, etc.

SECTION 14. The lock shall be built above the lower line of the dam, and the Boston and Maine Railroad shall, before the dam is completed, remove its bridge, piles and any other structures in Charles river which are southerly or westerly of a line defined in red on a plan filed in the office of the board of harbor and land commissioners marked "Plan showing line from above or southwest of which the Boston & Maine Railroad shall remove all of its structures in Charles River and between the harbor lines, May 25, 1903. Woodward Emery, Chairman of Harbor and Land Commissioners"; and may rebuild the same northerly and easterly of the line so defined. The draw in the new bridge shall not be easterly of nor more than fifty feet westerly from the location of the present draw, and shall be so located as to be directly opposite the lock. Within the limits herein prescribed the commission shall determine the position of the lock and draw.

Enforcement  
of provisions  
of act, etc.

SECTION 15. The supreme judicial court and the superior court shall, upon application of any party in interest, including any owner or occupant of property abutting on the basin or on Broad canal or Lechmere canal, have jurisdiction to enforce, or prevent violation of, any provision of this act and any order, rule or regulation made under authority thereof.



**SECTION 16.** Chapter three hundred and forty-four **Repeal.**  
of the acts of the year eighteen hundred and ninety-one, as amended by section one of chapter four hundred and thirty-five of the acts of the year eighteen hundred and ninety-three, and chapter five hundred and thirty-one of the acts of the year eighteen hundred and ninety-eight are hereby repealed.

**SECTION 17.** This act shall take effect on the first **When to take effect.**  
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## APPENDIX B.

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1. No. of Contract.	2. WORK.	3. No. of Bids.	AMOUNT OF BID.		6. Contractor.
			4. Next to Lowest.	5. Lowest.	
1	1	11	\$801,607 50	\$761,900 00	Holbrook, Cabot & Rollins Corpora- tion, Boston, Mass.
2	2	- <sup>1</sup>	- <sup>1</sup>	11,700 00	United States Wood Preserving Com- pany, New York, N. Y.

<sup>1</sup> Contract based upon this bid.

## APPENDIX B.

YEAR ENDING SEPT. 30, 1905.

7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Sept. 30, 1905.	
Jan. 14, '05,	July 15, '08,	-	For coffer-dam at the Boston end of dam, \$70,000; coffer-dam at the Cambridge end of dam, \$27,000; earth excavation, \$0.34, \$0.38, \$0.40, \$0.41, and \$0.45 per cu. yd.; coarse gravel, \$0.75 per cu. yd.; broken stone or screened gravel, \$1.50 per cu. yd.; riprap, \$1.50 per ton of 2,000 lbs.; round piles in place, \$0.24, \$0.30, \$0.14, \$0.15 and \$0.18 per lin. ft.; long-leaf yellow pine lumber, \$60 per M. ft. B. M.; spruce lumber, \$46, \$50, and \$35 per M. ft. B. M.; wrought iron and steel, \$0.06 per lb.; cast iron and cast steel, \$0.03 per lb.; concrete masonry, \$6.50, \$6, \$4.50 and \$5 per cu. yd.; ashlar masonry, \$18 and \$20.25 per cu. yd.; dimension stone masonry, \$36 per cu. yd.; face dressing, \$0.50 and \$0.80 per sq. ft.; placing iron and other metal work, \$25 per ton of 2,000 lbs.	\$801,607 50	\$101,930 12	1
Mar. 23, '05,	May 12, '05,	-	For furnishing and laying wooden block paving, \$3 per sq. yd.	11,700 00	4,782 52	2

\* Competitive bids were not received on this contract.

## APPENDIX B.

## CONTRACTS MADE DURING THE YEAR

1. No. of Contract.	2.  WORK.	3.  No. of Bids.	AMOUNT OF BID.		6.  Contractor.
			4. Next to Lowest.	5. Lowest.	
1	3 Section 2 of the Boston marginal conduit.	10	\$53,300 25	\$50,000 00 <sup>1</sup>	James Driscoll & Son, Brookline, Mass.
2	4 Cast-iron pipes and special castings.	2	6,690 12	5,640 75 <sup>1</sup>	Camden Iron Works, Philadelphia, Pa.
3	5 Furnishing and erecting pumps.	2	9,533 00 <sup>1</sup>	7,423 00	Henry R. Worthington, Boston, Mass.
4	6 Castings and other metal.	- <sup>1</sup>	- <sup>1</sup>	6,013 74	Gibby Foundry Company, East Boston, Mass.
5	7 <sup>1</sup> Yellow pine lumber for temporary bridge.	- <sup>1</sup>	- <sup>1</sup>	- <sup>1</sup>	George McQuesten Company, Boston, Mass.
6	8 <sup>1</sup> Granite paving blocks for temporary bridge.	3	1,960 00	1,923 25 <sup>1</sup>	Rockport Granite Company, Rockport, Mass.

<sup>1</sup> Contract based upon this bid.



## APPENDIX B.

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ENDING SEPT. 30, 1905 — *Continued.*

7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Sept. 30, 1905.	
June 13, '05,	Nov. 20, '05,	-	For earth excavation and refill, \$8.50 and \$7 per lin. ft. of trench; rock excavation, \$5 per cu. yd.; piles, \$0.14 per lin. ft.; underdrain, \$0.75 per lin. ft.; concrete masonry, \$7.50 and \$3.75 per cu. yd.; iron and other metal work, \$8 per ton of 2,000 lbs.; sheeting, \$18 per M. ft. B. M.; crossings of Fruit and Cambridge street overflows, \$8.	\$50,600 00	\$12,972 44	1
July 18, '05,	Sept. 16, '05,	-	For all standard straight pipe, \$24.90 per ton of 2,000 lbs.; all standard special castings, \$52.50 per ton of 2,000 lbs.; all special castings other than standard, \$95 per ton of 2,000 lbs.	5,640 75	-	2
Sept. 30, '05,	Apr. 1, '06,	-	For furnishing and erecting Pump No. 1, \$5,542; Pump No. 2, \$2,525; Pump No. 3, \$1,466.	9,533 00	-	3
July 27, '05,	Apr. 1, '06,	-	For iron castings unfinished, \$0.0393 per lb.; finished iron castings, \$0.0395 per lb.; finished steel castings, \$0.1032 per lb.; composition, \$0.43 per lb.; finished steel forgings, \$0.0708 per lb.; wrought iron and steel rods, bolts, etc., \$0.12 per lb.; rolled steel plates, \$0.05 per lb.	6,013 74	-	4
Feb. 14, '05,	-	July 22, '05,	For Schedule No. 1, \$30 per M. ft. B. M.; Schedule No. 2, \$34 per M. ft. B. M.; Schedule No. 3, \$34 per M. ft. B. M.; Schedule No. 4, \$29 per M. ft. B. M.	12,476 58	12,476 58	5
Mar. 22, '05,	Apr. 12, '05,	June 15, '05,	For 35,000 granite paving blocks, \$54.95 per thousand.	1,927 10	1,927 10	6

\* Competitive bids were not received on this contract.

\* Contract completed.



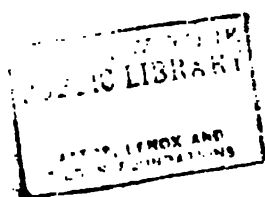
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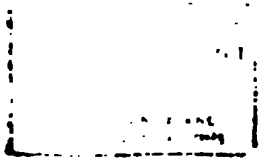
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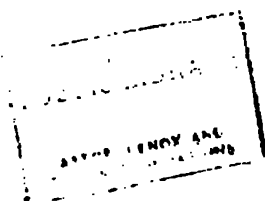
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BOSTON COFFER-DAM—EXCAVATION FOR LOCK.

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FOURTH ANNUAL REPORT

OF THE

CHARLES RIVER BASIN  
COMMISSION.

FROM

THE  CHARLES RIVER BASIN COMMISSION

367 BOYLSTON STREET



HENRY S. PRITCHETT

HENRY D. YERXA

JOSHUA B. HOLDEN

*Commissioners*

HIRAM A. MILLER  
*Chief Engineer*

WILLIAM S. YOUNGMAN  
*Secretary*



BOSTON :  
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,  
18 POST OFFICE SQUARE.  
1907.



**APPROVED BY**  
**THE STATE BOARD OF PUBLICATION.**



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# Commonwealth of Massachusetts.

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## FOURTH REPORT OF THE COMMISSION.

---

*To His Excellency the Governor and the Honorable Council of the Commonwealth of Massachusetts.*

The Commission appointed under chapter 465 of the Acts of the year 1903, called the Charles River Basin Commission, has the honor to make the following report of its proceedings for the fiscal year ending Nov. 30, 1906, instead of September 30, as in previous years. This change is made to comply with chapter 211 of the Acts of 1905. As required by law, the Commission filed, on Jan. 16, 1907, with the Secretary of the Commonwealth a statement of its expenditures and receipts, which is printed herewith.

### I. SUMMARY OF WORK DONE BY THE COMMISSION DURING ITS FIRST TERM OF OFFICE.

In the three years and four months from the date of its appointment to the end of the fiscal year covered by this report, the Commission has spent \$946,638.23. The work which this money has paid for may be summarized as follows:—

Old Craigie Bridge has been removed.

A new Craigie Temporary Bridge has been built and new approaches laid out and paved. About \$23,000 have been spent for the maintenance of this bridge, over which passes what is perhaps the heaviest traffic by teaming entering and leaving Boston on its northerly side. In providing the temporary bridge the Commission was able to utilize the Boston & Lowell freight bridge, at an estimated saving of \$15,000 to \$20,000.

One-third mile of the 7-foot Boston Marginal Conduit has been completed, thoroughly tested, and found to be first-

## 2 CHARLES RIVER BASIN COMMISSION. [Jan.

class in every particular. About  $1\frac{1}{2}$  miles of this conduit and  $\frac{1}{2}$  mile of the Cambridge Marginal Conduit yet remain to be constructed.

Piles have been driven and capped along 1 mile of frontage on the wharves of the Basin and on the Broad and Lechmere canals.

Four hundred thousand cubic yards of dredging have been done in the Basin and in the canals.

Work has been started upon the lowering of pipes, to prevent interference with navigation in the canals.

A coffer-dam, enclosing about  $4\frac{1}{2}$  acres of what was once the bottom of Charles River, has been constructed, and in it has been built the masonry work for many of the permanent hydraulic appurtenances of the Dam and the Boston Marginal Conduit, besides a Lock 490 feet long (which includes a draw at the lower end), 45 feet wide, and 27 feet deep at mean high tide. This has been known as the "Boston Cofferdam." *Fig. 1* shows the pile foundations for the structures to be built within the Boston coffer-dam. *Fig. 2* shows the masonry construction within the Boston coffer-dam.

In a smaller coffer-dam on the other side of the river, known as the "Cambridge Cofferdam," nine sluices have been erected. The middle sluice of this series has been arranged to serve a double purpose, so that when not in use as a sluice it may be operated as a lock for small boats which do not require so much head-room as to prevent their passage under the roadway, which will be at a level of 21 feet above mean low-water mark.

Preparations have been made for suitable approaches to the Dam.

Work has been begun on the Boston Embankment.

In connection with these various works the Commission has caused to be laid 35,700 cubic yards of concrete and has driven 490,000 linear feet of piles.

The Commission brought to public notice and proved extent to which the city of Boston was allowing the Stony Brook channels to be polluted by sewage.

The Legislature, by chapter 520 of the Acts of 1906, having granted to the Boston Elevated Railway Company the right to

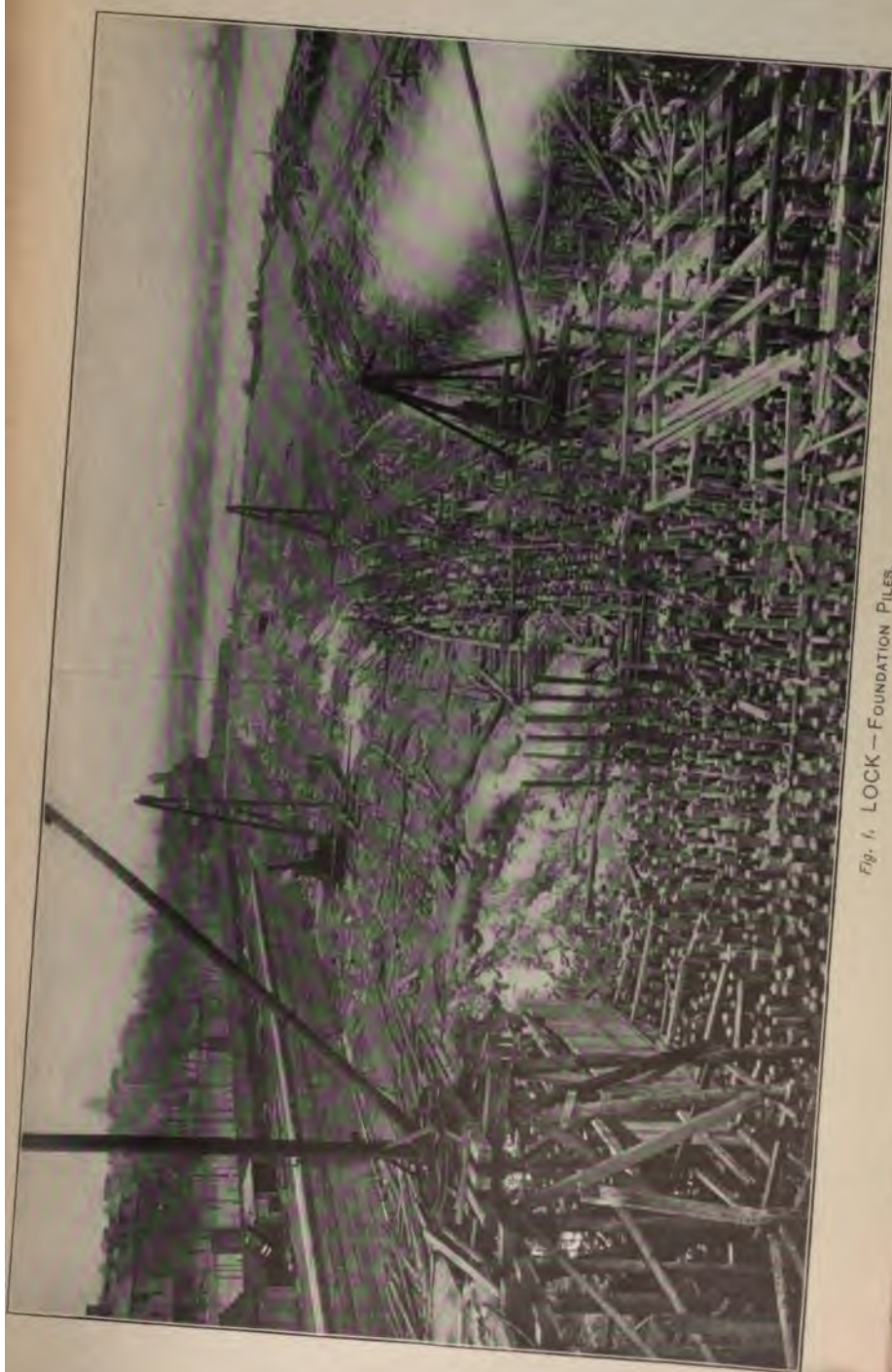


Fig. 1. LOCK — FOUNDATION PILES.







Fig. 2. LOCK AND BOSTON MARGINAL CONDUIT.



build an elevated structure on the down-stream slope of the Dam, the Commission has used its best endeavor, with the Board of Railroad Commissioners and otherwise, to keep the foundation of the Company's structure separate and independent of the foundations of the Dam, Lock and sluices.

The administrative details connected with the work above enumerated, and many other items not mentioned, have been handled with the utmost despatch consistent with safety.

All the Commission's work has been done without delay to traffic over the highway and without seriously interfering with navigation.

The cost of all the work done thus far is below the estimates presented to the Legislature of 1903.

## II. ORGANIZATION AND ADMINISTRATION.

### (a) *The Commission, Officers and Employees.*

On Aug. 1, 1906, the Commissioners were reappointed, and on August 7 they qualified, for a second term of three years. The membership of the Commission is the same as stated in the last report: Henry S. Pritchett, Chairman, Henry D. Yerxa and Joshua B. Holden. William S. Youngman has continued as Secretary, and Hiram A. Miller as Chief Engineer.

The administrative office force has remained the same this year as last. At the end of the year there were twenty-eight additional engineers and inspectors in the employ of the Commission. Promotions and other changes in the engineering force will be described in the report of the Chief Engineer, appended.

The Commission has been somewhat hampered by the difficulty of obtaining a sufficient number of engineers for all departments of its work.

### (b) *Offices and Buildings.*

The office of the Charles River Basin Commission is located, as in previous years, on the sixth floor of the Standish building, No. 367 Boylston Street. The principal field office is at No. 12 Bridge Street, East Cambridge, near the Cambridge end of Craigie Bridge. During the past year a second field office has

been opened, on the edge of the Basin Embankment, at the foot of Chestnut Street. The Commission also has a storehouse and work shed located at the foot of Leverett Street, near the Boston end of Craigie Bridge.

### III. THE DAM AND LOCK.

Work under the contract for the Dam and Lock (Contract No. 1) has been going forward with great rapidity during the year. Besides Contract No. 1, 31 smaller contracts have been signed for various machinery and fittings for the Dam and Lock. In the aggregate, upon all these contracts the Commission has expended during the year \$281,576.

#### (a) Work in Coffer-dam on Boston Side.

On Oct. 11, 1905, the work of pumping out the coffer-dam on the Boston side was begun. The water was lowered gradually, in order to permit the slopes to drain. On November 1 the pumping was practically completed, the water being lowered to a distance of about 35 feet below low tide.

Driving piles for the foundations of the Lock was started on November 1. On April 3, 1906, the first concrete was laid at the lower gate recess, and throughout the remainder of the year this work was continually in progress.

All the Lock structure is completed, and the granolithic walk on top of the Lock walls is finished from the upper end of the Lock to within 30 feet of the lower gate recess.

The truck girders for the drawbridge over the Lock have been embedded in the concrete.

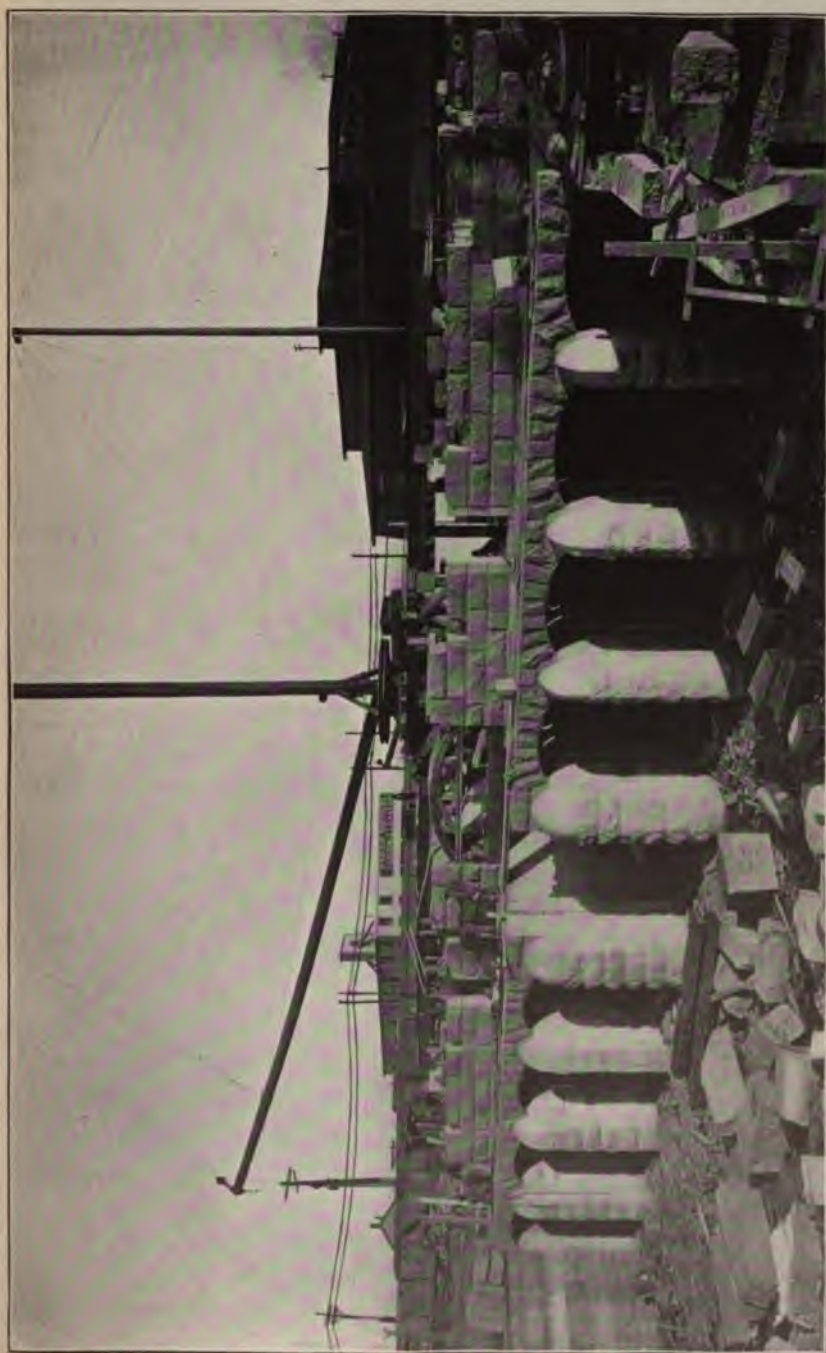
#### (b) Work in Coffer-dam on Cambridge Side.

The work of pumping out this smaller coffer-dam was completed on June 24, since which time some 3,000 cubic yards of concrete masonry have been placed within the coffer-dam, leaving about 500 cubic yards still to be laid.

#### (c) Temporary Dam and Lock. — *It will be a Flood Problem.*

By reason of a temporary dam which the Commission will construct between the Boston and Cambridge coffer-dams, the public will have the use of the Basin at an earlier date than





SLUICES—UP-STREAM FACE.



was anticipated. In a preliminary way the Basin will be established, for with the shut-off dam it is intended to maintain the level of the Basin at the grade of 8 feet above Boston base, or about  $21\frac{1}{2}$  feet below the average high tide. This shut-off dam will permit more rapid work upon the retaining walls and the earth fill of the permanent Dam and roadway. When the shut-off dam is operated the Commission will have an opportunity to work out in a practical way many problems which it has already considered theoretically. The interval between the operation of the shut-off dam and the completion of the permanent Dam will be the most difficult period of the Commission's work. The transformation into a fresh-water lake of a tidal estuary having  $17\frac{1}{2}$  miles of shore line is radical. The Commission has given much study to the probable effects of this change, and will endeavor to be prepared to meet all emergencies promptly as they arise. Many problems relating to the Basin can only be solved with certainty of success after the shut-off dam has been operated. The Commission is mindful of the fact that most of the territory contiguous to the Basin is filled land. On such land most of the buildings have their foundations resting upon piles. The Commission is seeking to adjust all its works in a way that will preserve foundation piles in as good condition as they are maintained under present conditions. Sanitary questions are also involved in the operation of the shut-off dam.

It was originally planned to complete the shut-off dam, and thus arrest the tidal flow in the river, about Aug. 1, 1907, but the Legislature of 1906 enforced upon the Commission a delay in this matter. The work of building the Boston Embankment, assigned in the Charles River Basin Act to the city of Boston, was turned over to this Commission by chapter 402 of the Acts of 1906. To build the embankment wall at a minimum cost to the city will require the postponement of the completion of the shut-off dam until a later date.

#### IV. THE BOSTON EMBANKMENT.

The Legislature's directions relative to the Boston Embankment are printed in Appendix A as an amendment to chapter 465 of the Acts of 1903. The limits of the embankment are

defined by law. From Charlesgate West easterly to a point near Berkeley Street it is to be 100 feet wide, and from that point it will curve to a point at right angles to the harbor line at the foot of Mt. Vernon Street, where it will be 300 feet wide; from that point it will gradually diminish in width until at a point near the Cambridge Bridge it will be about 200 feet wide.

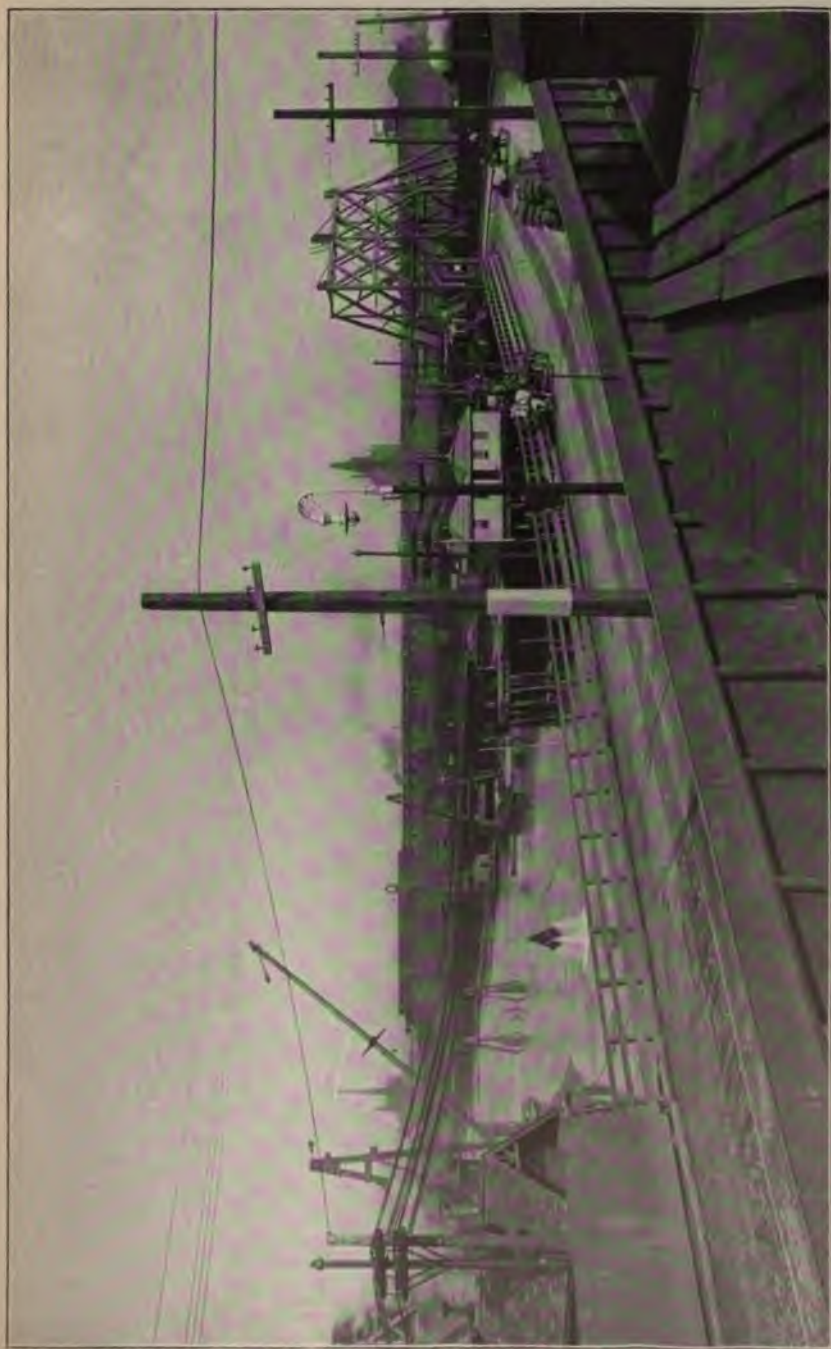
On the wider portion of the embankment, in the rear of Charles and Brimmer streets, besides a park there will be a roadway and sufficient area along the water front for the location of boat-houses. It is not planned to extend the driveway beyond Otter Street. The embankment, back of Beacon Street from Otter Street westerly to Charlesgate West, according to present plans, is to have a walk along the water side, seats back of the walk, and the remainder is to be devoted to green-sward and to planting. The Commission hopes it may be possible to so arrange the planting next to Back Street as to conceal as far as possible from the view of people on the embankment and on the Basin the unsightliness of that street and the stables in the rear of the houses on the north side of Beacon Street.

A part of the cost of the embankment is to be assessed upon the abutters in the form of betterments, and the Commission is keeping its accounts in such form that this assessment may be conveniently made soon after the completion of the work.

#### *A Possible Subway under the Embankment.*

The Commission had been advised of the possibility that the demand for the relief of the congestion of traffic on Boylston Street would result in the building of a subway to pass under the Boston Embankment. Accordingly, on April 3, 1906, it referred to the Boston Transit Commission the question as to the proper place for locating its marginal conduit so as to cause the least interference with the subway plan, in case the same were decided upon. Acting on the advice contained in a vote of the Boston Transit Commission at its meeting May 29, 1906, the Charles River Basin Commission laid out its marginal conduit, with the exception of the overflow chambers, a clear distance of about 30 feet from the existing wall of the

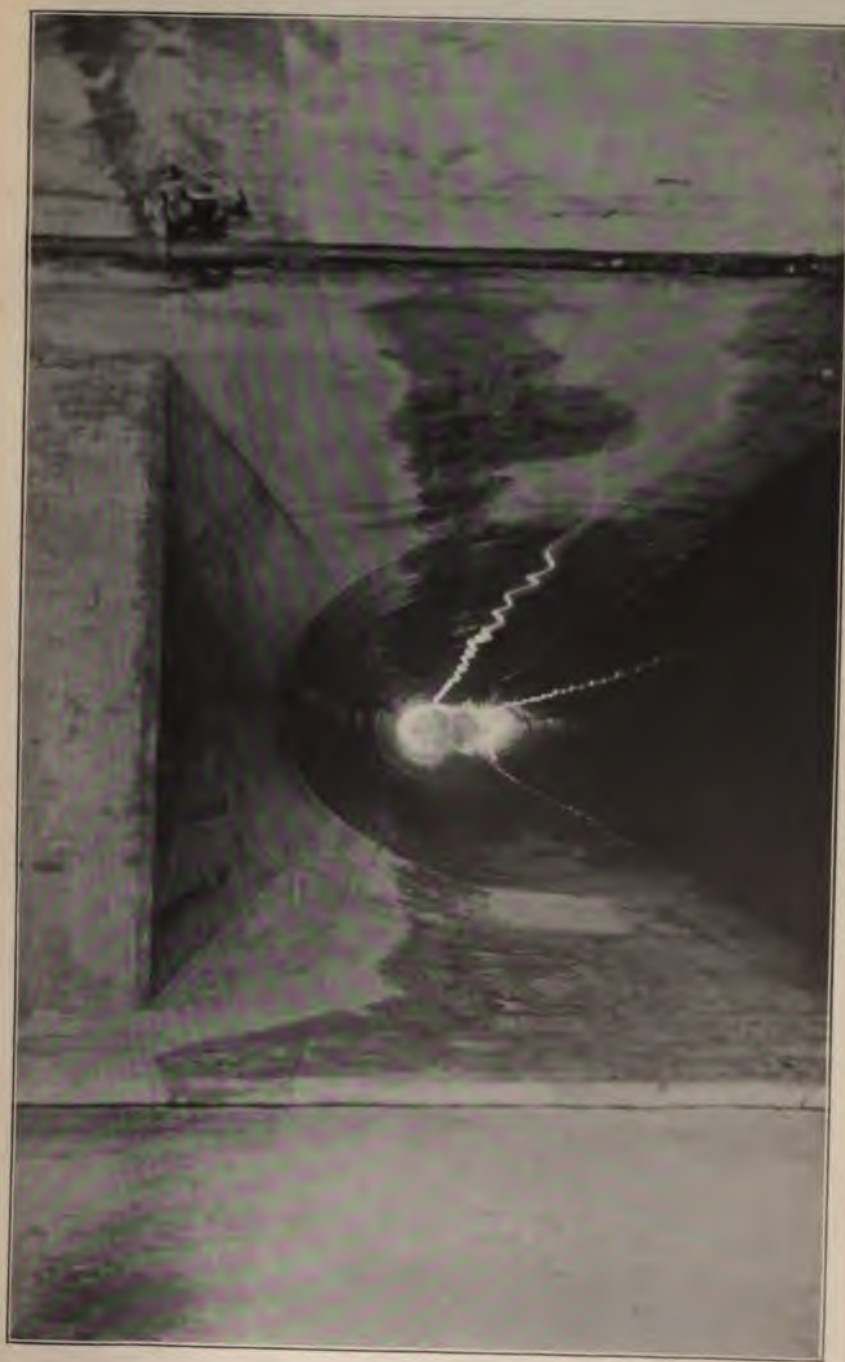




TEMPORARY BRIDGE.







BOSTON MARGINAL CONDUIT — OVERFLOW CONDUIT.



new embankment, and it is possible that the overflows can be reconstructed so that they will leave a clear distance of 30 feet.<sup>1</sup> Furthermore, the Commission provided, in its contracts for the embankment, for the possible diminution of the fill due to the construction of the subway.

#### V. THE CRAIGIE TEMPORARY BRIDGE.

The Commission has continued, as in the year 1905, to maintain and operate the Craigie Temporary Bridge, which connects Leverett Street in Boston with Bridge Street in Cambridge. When the roadway of the Dam is completed, this bridge will be torn away and arrangements will be perfected for holding and maneuvering vessels while waiting for the opening of the Lock or of the draw in the railroad bridge below.

#### VI. THE MARGINAL CONDUITS.

##### (a) *The Boston Marginal Conduit.*

Under Contract No. 1, the Holbrook, Cabot & Rollins Corporation drove, during January, February and March, foundation piles for Section 1 of the Boston Marginal Conduit, and work on the concrete masonry was started in July. This section is nearly completed.

Work on Section 2 of the Boston Marginal Conduit was in progress from a point some 250 feet south of Allen Street to the upper end of the section, at Cambridge Street. On the last day of December, 1905, pile-driving was completed, and the entire work on this section was completed Feb. 21, 1906.

The plans are ready for sections 3 and 4 of the conduit, and contracts for the remaining two sections will probably be let during 1907.

##### (b) *The Cambridge Marginal Conduit.*

Studies have been in progress for the Cambridge Marginal Conduit, which is intended to intercept the Binney Street sewer overflow at the junction of Binney Street and Commercial Avenue, thence running along Commercial Avenue for some

<sup>1</sup> By a subsequent vote of the Boston Transit Commission, confirmed by a letter of its acting chairman dated April 12, 1907, the Commission was advised to locate the marginal conduit 39 feet from the present Basin wall, upon which revised location the Commission is proceeding to build the conduit.

distance, turning into the park area belonging to the city of Cambridge, passing under the Lechmere Canal with an inverted siphon, and ending with an outlet into the westerly flood sluice at the Dam. A connection will also be made between the conduit and the Bridge Street sewer, so that storage in the two sewers in times of storms during the summer months can, if necessary, be equalized.

(c) *Pollution.*

When the Legislature of 1903 ordered the construction of the Boston Marginal Conduit, it was supposed that this conduit would take only sewage diluted with storm water in the times of sewer overflows, and the flow from the Stony Brook conduits, neither of which was supposed to be a sewer. From observation the Commission became convinced, early in the summer of 1906, that the Stony Brook conduits were in fact being used as sewers. Accordingly, the Commission requested Prof. Samuel C. Prescott to make careful investigations of the flow from these conduits which was coming into Charles River at Charles-

gate East. The result of Professor Prescott's study and examinations, covering a period of six weeks, was to prove that a very strong solution of house sewage was flowing almost constantly from these conduits. The Commission called the attention of the city authorities to this condition, and forwarded Professor Prescott's report to the State Board of Health. Owing to the fact that the Stony Brook conduits will be connected with the Boston Marginal Conduit, the ordinary flow from these conduits will not go into the Basin; but if the city authorities allow the Stony Brook conduits to be used as sewers, they will be responsible for the creation of a nuisance at the outlet of the Boston Marginal Conduit, which will be just below the Dam. The city of Boston may, however, be compelled by the State Board of Health to abate any nuisance which is created in Charles River by the misuse of the Stony Brook conduits, on complaint of the mayor of a city or the selectmen of a town, under chapter 158 of the Acts of 1906.





BROAD CANAL — WALLS BEFORE DRIVING PILES

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BROAD CANAL — WALLS AFTER DRIVING PILES.



## VII. DREDGING AND PILE-DRIVING IN THE BASIN AND IN BROAD AND LECHMERE CANALS.

As advised by the Attorney-General, the Commission is not required by law to complete the work in the canals before the permanent Dam is completed; but, since it is the intention of the Commission to construct and operate a shut-off dam as soon as possible, consistent with convenience, economy and safety to the other work in its charge, the Commission has gone forward with the work of driving piles and of dredging, in both Broad and Lechmere canals. On Dec. 4, 1905, a contract was signed with Holbrook, Cabot & Rollins Corporation for the pile-driving in the canals. The dredging in the canals was provided for in Contract No. 1, for the Dam and Lock. Part of this dredging has been done during the year by the Eastern Dredging Company, who are subcontractors of the Holbrook, Cabot & Rollins Corporation.

On Dec. 30, 1905, pile-driving was begun in Broad Canal, in front of the property of the Rawson & Morrison Manufacturing Company on the southerly side. This work had progressed to such an extent that at the end of the year piles had been driven in front of all except parts of three properties on the northerly side of the canal.

In Lechmere Canal piles had been driven in front of about half the properties.

The dredging at the entrance to Broad Canal was begun on Aug. 25, 1906, and dredging in Broad Canal above First Street on September 4. This work was continued with some interruptions until the end of the year, at which time it was substantially completed from the entrance of the canal to a point about 400 feet below Third Street. The work from Third Street to Sixth Street, and beyond to the railroad and the property of the Geo. G. Page Box Company, will soon be started.

## VIII. APPROVAL OF THE WAR DEPARTMENT.

On application, the War Department transferred to the Commission, under date of Aug. 8, 1906, the license granted to the city of Boston to build the Boston Embankment, according to



## CHARLES RIVER BASIN COMMISSION. [Jan.

1. The Department also issued to the Commission to modify the cross-section of the embankment and to conform with plans worked out by the Commission authority of chapter 402 of the Acts of 1906.

### IX. LEGISLATION OF 1906.

The Legislature of 1906, pursuant to the recommendation of the Commission in its report for the year 1905, decided that the machinery of the drawbridges over the Lock and the machinery of the Lock and sluices should be under the same control. By chapter 368 of the Acts of 1906 the responsibility for the control of this machinery, as well as other matters relating to the care, maintenance and policing of the Dam and the Basin, was given to the Metropolitan Park Commission. Provision was also made, in section 3 of chapter 368 of the Acts of 1906, for the turning over of the Basin, the Dam, the Lock and all their appurtenances to the Metropolitan Park Commission by this Commission upon the completion of its work.

### X. TAKINGS OF PROPERTY.

On Oct. 8, 1906, the Commission filed with the Suffolk Registry of Deeds a taking of such property rights as would be necessary to the construction of the Boston Embankment along the shore of the river from Cambridge Bridge to Charlesgate West.

After careful study of the situation and consultation with real estate experts, the Commission, on March 26, 1906, made an award of damages, under chapter 317 of the Acts of 1904, of \$90,024.57 with interest, for taking the property of Mr. George O. Proctor for the Cambridge approach to the Dam. Mr. Proctor refused to accept the award as a settlement in full, and has filed a petition to recover additional damages.

### XI. LITIGATION.

Petitions for damages against the Commonwealth on account of the Charles River Basin work, filed by Isaac Cohen *et al.*, by George O. Proctor and by Hazen E. Ricker *et al.*, are pending in the county of Middlesex.

## XII. CONTRACTS AWARDED.

(a) *Labor.*

Since the passage of chapter 517 of the Acts of 1906, the provision of law that no laborer, workman or mechanic on any of the Commission's work shall be required to work more than eight hours in any calendar day, has been made a part of all contracts.

(b) *List of Contracts.*

A detailed statement of the contracts awarded and pending during the year will be found in Appendix B, and is discussed in the Chief Engineer's report, annexed.

(c) *Sums held back from Contractors.*

The amounts reserved from sums due the contractors on monthly estimates, and not payable until after the completion of the contracts or until final settlement, are as follows:—

No. of Contract.	Name.	Work.	Amount.
1	Holbrook, Cabot & Rollins Corporation.	Dam and lock, . . . . .	\$60,000 00
2	United States Wood Preserving Company.	Wooden block paving for temporary bridge.	843 98 <sup>1</sup>
23	Holbrook, Cabot & Rollins Corporation.	Piles along walls of canals and Basin.	7,692 00
24	American Bridge Company of New York.	Scherzer rolling lift bridge, . .	1,133 97
28	Coffin Valve Company, . . . .	Tide-gates at the Dam and Lock, .	1,775 20
33	Chelmsford Foundry Company, .	Furnishing castings and other metal.	107 03
35	Gibby Foundry Company, . . .	Furnishing castings and other metal.	396 65
44	Coleman Brothers, . . . . .	Section 3 of the Boston Marginal Conduit and Section 1 of the Boston Embankment.	2,372 79
			\$74,321 62

<sup>1</sup> Owing to the unsatisfactory condition of the work, an additional sum, amounting to \$5,626.50, has been held back by the Commission.

## XIII. HEARINGS.

During the year the Commission gave the following hearings:—

To Mr. Joseph Driscoll, representing James Driscoll & Son,

## 11 CHARLES RIVER BASIN COMMISSION. [Cal

continued on p. 56] Section 1 of the Boston Maritime Commission has been held in three hearings:

1. Messrs. John Rice and A. E. Clements representing the Charles River Water Transporting Company and their engineer, Mr. J. C. Wheeler, relative to the raising of the piling to increase the company's low tide temporary bridge and mooring.

2. Mr. George W. Chapin representing the consumers of fuel oil, and Mr. John A. Whittier, owner, relative to driving the piles in front of their wharf in Broad Canal.

3. Messrs. George W. Chapin representing the consumers of fuel oil, and Thomas J. Kilgus representing the Cambridge Fuel Oil Company, relative to arrangements for dredging in Broad Canal.

4. Mr. J. C. Wheeler representing the Cambridge Fuel Oil Company, relative to work of unloading and driving piles in front of the Cambridge wharf in Broad Canal.

5. Mr. George W. Chapin, Mr. James William A. Hennessey and Mr. John A. Whittier representing the consumers of fuel oil, relative to the raising of the piles in front of the wharf of the Cambridge Fuel Oil Company, and Mr. Arthur J. Kilgus representing the Cambridge Fuel Oil Company, relative to the raising of the piles in front of the wharf of the Cambridge Fuel Oil Company, and Mr. Arthur J. Kilgus representing the Cambridge Fuel Oil Company, relative to the raising of the piles in front of the wharf of the Cambridge Fuel Oil Company.

6. Mr. George W. Chapin representing the Cambridge Fuel Oil Company, relative to the raising of the piles in front of the wharf of the Cambridge Fuel Oil Company, and Mr. Arthur J. Kilgus representing the Cambridge Fuel Oil Company, relative to the raising of the piles in front of the wharf of the Cambridge Fuel Oil Company.

7. Mr. George W. Chapin representing the Cambridge Fuel Oil Company, relative to the raising of the piles in front of the wharf of the Cambridge Fuel Oil Company, and Mr. Arthur J. Kilgus representing the Cambridge Fuel Oil Company, relative to the raising of the piles in front of the wharf of the Cambridge Fuel Oil Company.

8. Mr. George W. Chapin representing the Cambridge Fuel Oil Company, relative to the raising of the piles in front of the wharf of the Cambridge Fuel Oil Company, and Mr. Arthur J. Kilgus representing the Cambridge Fuel Oil Company, relative to the raising of the piles in front of the wharf of the Cambridge Fuel Oil Company.

9. Mr. George W. Chapin representing the Cambridge Fuel Oil Company, relative to the raising of the piles in front of the wharf of the Cambridge Fuel Oil Company, and Mr. Arthur J. Kilgus representing the Cambridge Fuel Oil Company, relative to the raising of the piles in front of the wharf of the Cambridge Fuel Oil Company.

10. Mr. George W. Chapin representing the Cambridge Fuel Oil Company, relative to the raising of the piles in front of the wharf of the Cambridge Fuel Oil Company, and Mr. Arthur J. Kilgus representing the Cambridge Fuel Oil Company, relative to the raising of the piles in front of the wharf of the Cambridge Fuel Oil Company.

Cambridge and relative to his acceptance of the award of damages made by the Commission, three hearings.

To Mr. Hazen E. Ricker, representing E. Ricker, Son & Co., and his counsel, Mr. Paul R. Blackmur, relative to a claim for damages to E. Ricker, Son & Co. as lessees of a part of the Proctor property taken by the Commission, three hearings.

To Mr. Lucius Tuttle, representing the Boston & Maine Railroad, and General William A. Bancroft, representing the Boston Elevated Railway Company, relative to the laying of elevated railway tracks upon the Dam.

To Mr. Robert Winsor and General William A. Bancroft, representing the Boston Elevated Railway Company, relative to the Commission's objections to the proposed act for carrying an elevated railway structure across the Dam.

The Commission held a consultation with Chairman William B. de las Casas and Hon. Edwin U. Curtis, representing the Metropolitan Park Commission, and Mr. John R. Rablin, Chief Engineer of that Commission, relative to buildings to be erected on the Dam, and other matters affecting the maintenance of the Dam and Basin after the completion of the same.

#### XIV. ISSUE OF BONDS.

On Jan. 10, 1906, the Commission voted to advise the Treasurer of the Commonwealth to make available additional funds to the amount of \$600,000 for the year 1906. Bonds to the amount above named were issued under the title of the "Charles River Basin Loan," and \$515,000 were sold. The remaining \$85,000 were held by the Treasurer at the end of the fiscal year. The total issue of bonds on account of the Charles River Basin Loan to Dec. 1, 1906, is \$1,165,000.

#### XV. PAYMENTS TO THE SINKING FUND.

Payments to the sinking fund during the year amounted to \$26,421. The total payments to the sinking fund to Dec. 1, 1906, amount to \$65,112.80.

## XVI. REPORTS ISSUED BY THE COMMISSION.

Fifteen hundred reports were printed, at a cost of \$659.01. Of this number the Commission was allowed 350 copies to meet the demands of officials and citizens of the 38 cities and towns which are to pay for the Charles River Basin work. The supply fell far short of the demand.

## XVII. STATEMENT OF EXPENDITURES AND RECEIPTS.

The following statement of expenditures and receipts was filed on Jan. 16, 1907:—

*Expenditures.*

The total amount of expenditures from Oct. 1, 1905, to Nov. 30, 1906, is \$683,566.09. The total amount from July 29, 1903, the date of the organization of the Commission, to Nov. 30, 1906, is \$946,638.23.

The general character of these expenditures is as follows:—

	From Oct. 1, 1905, to Nov. 30, 1906 (14 Months).	From Beginning of Work to Nov. 30, 1906 (3 Years, 4 Months).	
<i>Administration.</i>			
Commissioners, . . . . .	\$11,896 67	\$25,024 69	
Secretary, . . . . .	5,100 00	5,483 33	
Clerks and stenographers, . . . . .	1,100 00	2,242 84	
Legal services, . . . . .	8 00	8 00	
Traveling, . . . . .	85 54	293 73	
Stationery and printing, . . . . .	916 41	1,764 82	
Postage, express and telegrams, . . . . .	48 58	102 34	
Furniture and fixtures, . . . . .	131 90	444 61	
Alterations and repairs of building, . . . . .	-	123 10	
Telephone and lighting, . . . . .	184 38	244 79	
Rent, . . . . .	333 34	1,053 38	
Miscellaneous expenses, . . . . .	57 05	149 57	
	\$17,587 87	\$44,504 00	
<i>Engineering.</i>			
Chief, principal assistant and division engineers, . . . . .	\$12,736 11	\$33,330 35	
Engineering assistants, . . . . .	32,334 24	60,310 23	
Consulting engineers, . . . . .	1,517 30	6,538 40	
Inspectors, . . . . .	16,879 49	19,967 95	
Architect, . . . . .	512 72	1,094 72	
Traveling, . . . . .	448 49	572 04	
Wagon hire, . . . . .	2 00	60 50	
Stationery and printing, . . . . .	1,149 50	2,804 17	
Postage, express and telegrams, . . . . .	65 20	145 29	
Instruments and tools, . . . . .	1,567 73	4,260 50	
Engineering and drafting supplies, . . . . .	633 95	1,166 67	
Books, maps and photographs, . . . . .	1,154 16	1,749 44	
Furniture and fixtures, . . . . .	432 71	2,321 70	
Alterations and repairs of building:—			
Main office, . . . . .	-	1,092 14	
Sub-offices, . . . . .	107 37	821 43	
Telephone and lighting, main office, . . . . .	282 60	610 54	
<i>Amounts carried forward,</i> . . . . .	\$63,414 63	\$135,505 16	\$44,504 00



	From Oct. 1, 1905, to Nov. 30, 1906 (14 Months).		From Beginning of Work to Nov. 30, 1906 (3 Years, 4 Months).	
<i>Amounts brought forward,</i> . . .	\$69,414 63	\$17,557 87	\$135,595 16	\$44,934 00
<i>Engineering—Con.</i>				
Telephone, lighting, heating and care of building, sub offices, . . . . .	361 29		556 17	
Rent, main office, . . . . .	2,000 04		5,446 51	
Rent of field office, . . . . .	—		251 45	
Unclassified supplies, . . . . .	87 40		133 34	
Miscellaneous expenses, . . . . .	114 07		209 10	
		71,977 43		142,211 73
<i>Construction—Preliminary.</i>				
Advertising, . . . . .	\$455 70		\$775 19	
Labor, . . . . .	212 48		5,213 42	
Traveling, . . . . .	—		19 08	
Water rates, . . . . .	—		3 45	
Freight and express, . . . . .	10 00		61 17	
Jobbing and repairing, . . . . .	—		35 68	
Tools, machinery, appliances and hard- ware supplies, . . . . .	25 00		210 76	
Castings, ironwork and metals, . . . .	16 55		218 09	
Iron pipe and valves, . . . . .	—		98 96	
Fuel, oil and waste, . . . . .	—		62 65	
Lumber, . . . . .	—		338 08	
Cement, . . . . .	—		24 75	
Sand, . . . . .	—		3 00	
Unclassified supplies, . . . . .	—		14 69	
Miscellaneous expenses, . . . . .	35 32		391 16	
		765 05		7,470 13
<i>Construction—Contracts.</i>				
Contracts completed and final payments made prior to Oct. 1, 1905, . . . . .	—		\$21,033 69	
Contract No. 1, Holbrook, Cabot & Rollins Corporation, . . . . .	\$306,779 71		408,709 83	
Contract No. 2, United States Wood Pre- serving Co., . . . . .	—		4,782 52	
Contract No. 3, James Driscoll & Son, . .	39,410 66		52,383 10	
Contract No. 4, Camden Iron Works, . .	5,833 86		5,833 86	
Contract No. 5, Henry R. Worthington, . .	2,859 90		2,859 90	
Contract No. 6, Gibby Foundry Co., . . .	6,262 48		6,262 48	
Contract No. 13, Aberthaw Construction Co.,	773 92		5,388 72	
Contract No. 14, Gibby Foundry Co., . . .	736 80		736 80	
Contract No. 15, Coffin Valve Co., . . .	1,801 54		1,803 89	
Contract No. 16, The Boston Bridge Works,	1,308 67		1,308 67	
Contract No. 17, The Lumsden & Van Stone Co., . . . . .	3,975 75		3,975 75	
Contract No. 18, The Ludlow Valve Manu- facturing Co., . . . . .	861 95		861 95	
Contract No. 19, The Scherzer Rolling Lift Bridge Co., . . . . .	3,500 00		3,500 00	
Contract No. 20, Geo. McQuesten Co., . .	3,394 69		3,394 69	
Contract No. 21, E. D. Sawyer Lumber Co.,	1,033 76		1,033 76	
Contract No. 22, Gow & Palmer, . . . .	1,681 03		1,681 03	
Contract No. 23, Holbrook, Cabot & Rollins Corporation, . . . . .	43,587 98		43,587 98	
Contract No. 24, American Bridge Com- pany of New York, . . . . .	2,026 19		2,026 19	
Contract No. 26, E. Gerry Emmons Corpo- ration, . . . . .	525 00		525 00	
Contract No. 28, Coffin Valve Co., . . .	2,662 80		2,662 80	
Contract No. 29, Aberthaw Construction Co.,	3,461 66		3,461 66	
Contract No. 31, The William Cramp & Sons Ship & Engine Building Co., . . . . .	1,029 60		1,029 60	
Contract No. 32, Geo. W. Gale Lumber Co.,	3,479 10		3,479 10	
Contract No. 33, Chelmsford Foundry Co.,	606 47		606 47	
Contract No. 34, Geo. McQuesten Co., . .	54 15		54 15	
Contract No. 35, Gibby Foundry Co., . .	2,247 67		2,247 67	
Contract No. 36, Fred A. Houdlette & Son,	682 81		682 81	
Contract No. 39, H. W. Hayes & Co., . .	944 20		944 20	
Contract No. 42, New England Structural Co., . . . . .	4,557 00		4,557 00	
Contract No. 44, Coleman Bros., . . . .	13,445 78		13,445 78	
Contract No. 52, Aberthaw Construction Co.,	225 31		225 31	
		460,650 44		626,006 36
<i>Amounts carried forward,</i> . . . . .	\$550,940 79			\$800,622 22

	From Oct. 1, 1905, to Nov. 30, 1906 (14 Months).	From Beginning of Work to Nov. 30, 1906 (3 Years, 4 Months).
<i>Amounts brought forward,</i> . . . . .	\$550,940 79	\$800,622 22
<i>Construction—Additional.</i>		
Labor, . . . . .	\$26,944 13	\$31,338 87
Professional services, . . . . .	202 00	202 00
Travelling, . . . . .	—	86
Freight and express, . . . . .	119 57	123 87
Jobbing and repairing, . . . . .	449 79	622 76
Tools, machinery, appliances and hard- ware supplies, . . . . .	1,577 99	6,278 65
Castings, ironwork and metals, . . . . .	2,115 58	2,311 91
Iron pipe and valves, . . . . .	2,293 90	2,300 81
Paint and coating, . . . . .	28 46	35 46
Fuel, oil and waste, . . . . .	402 83	441 36
Lumber and field buildings, . . . . .	1,290 21	4,379 12
Cement and stone, . . . . .	2 05	6 05
Sand, . . . . .	36 00	40 00
Municipal and corporation work, . . . . .	589 00	855 97
Unclassified supplies, . . . . .	68 53	257 49
Miscellaneous expenses, . . . . .	1,596 34	1,757 22
<i>Real Estate.</i>	37,716 38	50,947 40
Legal and expert, . . . . .	\$173 06	\$332 75
Payment <i>pro tanto</i> under chapter 317, Acts of 1904, . . . . .	94,735 86	94,735 86
	94,908 92	95,068 61
Totals, . . . . .	\$683,566 09	\$946,638 23

The foregoing expenditures have been distributed among the various objects or works as follows:—

	From Oct. 1, 1905, to Nov. 30, 1906 (14 Months).	From Beginning of Work to Nov. 30, 1906 (3 Years, 4 Months).
Administration, applicable to all parts of the work, . . . . .	\$17,557 87	\$44,934 00
Dam, . . . . .	205,105 71	244,120 50
Lock, . . . . .	234,231 74	303,760 42
Temporary bridge and approaches, . . . . .	34,573 44	112,443 09
Drawbridge, . . . . .	24,218 47	33,078 03
Highway, . . . . .	49 00	109 92
Dredging and pile-driving in Basin, . . . . .	19,368 03	20,042 94
Broad Canal, . . . . .	41,878 14	44,839 26
Lechmere Canal, . . . . .	7,173 68	8,711 58
Boston Embankment, . . . . .	23,800 11	23,800 11
Boston Marginal Conduit, . . . . .	74,559 41	108,818 14
Cambridge Marginal Conduit, . . . . .	1,050 49	1,980 24
Totals, . . . . .	\$683,566 09	\$946,638 23

### Receipts.

The total amount of receipts from Oct. 1, 1905, to Nov. 30, 1906, is \$1,478.33, which sum represents also the total receipts from July 29, 1903, the date of the organization of the Commission, to Nov. 30, 1906. The receipts were mostly from

rents of the Proctor property in East Cambridge, and from sale of old lumber from the temporary bridge.

The general character of these receipts is as follows:—

	From Oct. 1, 1905, to Nov. 30, 1906 (14 Months).	From Beginning of Work to Nov. 30, 1906 (3 Years, 4 Months).
<i>To the Credit of the Loan Fund.</i>		
Supplies, . . . . .	\$63 00	\$63 00
<i>To the Credit of the Sinking Fund.</i>		
Rents, . . . . .	1,415 33	1,415 33
Totals, . . . . .	\$1,478 33	\$1,478 33

The foregoing receipts have been credited to the various objects or works as follows:—

	From Oct. 1, 1905, to Nov. 30, 1906 (14 Months).	From Beginning of Work to Nov. 30, 1906 (3 Years, 4 Months).
Dam, . . . . .	\$1,416 83	\$1,416 83
Lock, . . . . .	1 50	1 50
Temporary Bridge and approaches, . . . . .	59 00	59 00
Boston Marginal Conduit, . . . . .	1 00	1 00
Totals, . . . . .	\$1,478 33	\$1,478 33

The report of the Chief Engineer follows.

In Appendix A will be found chapter 465 of the Acts of 1903, as amended by chapter 65 of the Acts of 1905 and chapters 368 and 402 of the Acts of 1906, together with chapter 107 of the Resolves of 1904 and chapter 158 of the Acts of 1906, being all the other acts relating to the Charles River Basin work.

The Commission desires to report a busy year of work and one of satisfactory progress. The problem of the Commission has been changed and made much more complex by having added to its work the construction of the embankment along the back of Brimmer Street and Beacon Street. All these de-

tails, however, have been taken up and pushed with as great rapidity as the circumstances would admit, for which the Commission is indebted to the efficiency and energy of its various officials and employees.

Respectfully submitted,

HENRY S. PRITCHETT,  
HENRY D. YERXA,  
JOSHUA B. HOLDEN,

*Charles River Basin Commission.*

Boston, Jan. 17, 1907.



## REPORT OF THE CHIEF ENGINEER.

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*To the Charles River Basin Commission.*

GENTLEMEN:— The following is a report of the work of the engineering department for the fourteen months ending Nov. 30, 1906.

### ORGANIZATION.

Mr. Frank E. Winsor continued as principal assistant engineer until April 10, 1906, when he resigned to accept a better position with the Board of Water Supply of New York City.

Mr. John L. Howard continued as division engineer, in charge of field work.

Upon the resignation of Mr. Winsor, Mr. Edward C. Sherman, assistant engineer, was promoted to the position of division engineer, in charge of designing, drafting and other office work.

Mr. Frederic P. Stearns continued to act as consulting engineer.

Mr. Guy Lowell was consulted in architecture and landscape architecture.

Mr. John R. Worcester was consulted in regard to structural steel work.

Mr. Staunton B. Peck, of Chicago, Ill., was consulted in regard to the operating machinery of the rolling Lock-gates.

Mr. F. W. Dean, of Dean & Main, was consulted in regard to the boiler plant required at the Dam.

The engineering force at the beginning of the year numbered 35, and was increased from time to time as the work required, until at the end of the year it numbered 69.

The names of the assistants in the engineering department, not mentioned above, who have been employed for not less than one month, are given below, with the positions last held, together with an indication of the work performed by them:—



## 22 CHARLES RIVER BASIN COMMISSION. [Jan.

John P. McKnight,	. . .	Inspector,—on Lock and sluice masonry.
Samuel B. Horton,	. . .	Inspector,—on pile-driving.
Robert P. O'Keefe,	. . .	Inspector,—on Lock and sluice masonry.
Samuel Taylor,	. . .	Inspector,—on pile-driving.
Thomas L. Whelan,	. . .	Inspector,—on masonry and pile-driving.
Walter A. Livermore,	. . .	Inspector,—on pile-driving and setting metal at sluices.
George O. Souci,	. . .	Inspector,—on pile-driving.
Daniel J. Sullivan,	. . .	Inspector,—on paving and pile-driving.
George L. Bosworth,	. . .	Assistant inspector.
Bernard E. Grant,	. . .	Assistant inspector.

### *Stenographers and Clerks.*

Jennie L. Rawson,	. . .	Stenographer and clerk,—administrative work, accounts and letters.
Mabel F. Paton,	. . .	Stenographer and clerk.
Edith F. White,	. . .	Stenographer and clerk.
Ethelyn B. Marlatt,	. . .	Stenographer and clerk.
Hortense de Coen,	. . .	Stenographer.
Alfred Wm. Treen,	. . .	Clerk and messenger.

In addition to the above regular employees, Mr. Herbert L. Sherman, 220 Devonshire Street, Boston, continued to have charge of the cement testing; Mr. William R. Conard, of Burlington, N. J., continued in charge of inspection of pipes and specials manufactured in that locality; Stowell & Cunningham, of Albany, N. Y., were employed as inspectors of mill and shop work on structural steel for the drawbridge and Lock-gates and other structural material; Prof. C. E. Fuller, of the mechanical engineering department of the Massachusetts Institute of Technology, made physical tests on twisted steel rods, cast steel, bronze and other metals; and Mr. Squire Howarth, 7 Regent Square, Roxbury, an expert machinist, inspected material being made at various foundries and machine shops.

The principal engineering office was continued at 367 Boylston Street, Boston; an office for the field force was continued at 12 Bridge Street, East Cambridge; and on Nov. 5, 1906, another office for the field force was established at 108 Chestnut Street, Boston.

## DAM AND LOCK.

A large part of the time of the office force was devoted to the preparation of the necessary working drawings for Contract No. 1 for the Dam and Lock, as the contract plans for this work were general in character, the final study of a great many of the details being left for further attention. Some one hundred drawings, showing details of concrete and granite masonry, pile foundations, and steel reinforcement of concrete, were made in connection with this work.

The condition of the work on the Dam and Lock at the end of the period covered by this report was as follows: —

The concrete masonry of the Lock structure was substantially completed, and the granolithic surface on top of the Lock walls was finished from the upper end of the Lock to within 30 feet of the lower gate recess. All of the bollards and sheaves and the anchor bolts for the two capstans were in place. The bed-plates for some of the machinery for operating the Lock-gates had been set. The pump-wells were finished and ready to have the pumps set up. The steel work for the Scherzer rolling lift bridge was being delivered, and the track girders to support the same had been set in place.

At the sluices, substantially all of the concrete below the floor of the gate-chambers was completed, some 3,500 cubic yards of concrete having been placed, leaving 500 or 600 cubic yards required to finish the work, and about one-half of the steel work for the gate chambers was in place. The greater part of the stone masonry for the face walls of the sluices was on hand, and rather more than one-half of it had been set.

*Coffer-dam at the Boston Side of the River.*

At the close of the period included in the last annual report, the sheeting for the Boston coffer-dam being constructed by the Holbrook, Cabot & Rollins Corporation under Contract No. 1 had all been driven, but there still remained some bracing and considerable filling to be done before pumping out the coffer-dam. Prior to starting the pump, the sluice-gates were closed at low water and maintained in that condition until the next low

water, during which time the water surface inside the coffer-dam rose 0.65 of a foot under a maximum head of about 9 feet. This would equal a leakage of about 2.6 cubic feet per second. The coffer-dam (which was described in the report for the year ending Sept. 30, 1905) is about 400 feet long by about 250 feet wide, and contains some 4 acres. In order to prevent any sliding or movement of the banks of the coffer-dam, caused by lowering the water surface too rapidly, the water was lowered gradually, as shown by the following table:—

*Elevations of Water in Cofferdam as Pumping out progressed.*

At start, October 11, . . . . .	102.0	October 21, <sup>1</sup> . . . . .	79.7
October 12, . . . . .	94.7	October 24, . . . . .	77.3
October 13, . . . . .	90.0	October 27, . . . . .	73.3
October 15, . . . . .	88.0	October 28, . . . . .	70.0
October 16, . . . . .	87.3	October 30, . . . . .	67.5
October 17, . . . . .	85.0	October 31, . . . . .	66.5
October 18, . . . . .	83.0	November 1, . . . . .	65.0
October 19, . . . . .	80.0		

The pumping out of the coffer-dam was done by a 15-inch direct-connected centrifugal pump built by the Lawrence Machine Company, and steam was supplied from a 150 horsepower boiler with steam at 100 pounds pressure. After the coffer dam was pumped out, several leaks around the sluice-gates were culked, and since that time the pumping has been quite uniform and constant, the 6-inch pump running from 45 to 50 hours a week, or the 15-inch pump running from 16 to 20 hours a week, taking care of the leakage under ordinary conditions. The boiler was supported on a pile foundation built just outside the line of the Lock and adjacent to the proposed location of the pump-well. The 15-inch pump was mounted on a pontoon, and the discharge was through sections of 24-inch spiral riveted galvanized-iron pipe about 2 feet in length. As the water lowered, additional sections were added to the discharge pipe until the pontoon grounded. The steam connection was through a flexible hose 4 inches in diameter, similar to those used for connections with steam drills. As soon as the water was pumped out, ditches were conducted the water to the pump-well, which was immediately started. The pump-well was 15 feet square at

<sup>1</sup> Began excavating.

top and 11 feet square at bottom, built of 6-inch splined sheeting, and was carried down to elevation 63.0, nearly 10 feet below the bottom of the concrete in the main portion of the Lock, which is to be at elevation 72.6.

Earth excavation was continued from time to time in advance of the pile-driving and placing of masonry, as was convenient and desirable for the Contractor.

#### *Foundations for the Lock.*

Before the pumping out was entirely completed, a pile-driver was set up by the Holbrook, Cabot & Rollins Corporation, the contractor under Contract No. 1, on blocking in the bottom of the excavation for the Lock, to drive piles for a trestle from which the foundation piles for the bottom of the Lock could be driven. This pile-driver was built with an overhang of 16 feet, so that piles could be driven in bents 14 feet in advance, on which timbers were laid, forming a platform upon which a second pile-driver with extension gins was operated to fill in the piles between the 14-foot bents.

Pile-driving was continued all through the winter, except for occasional stormy days, so that by the time the weather was warm enough to lay concrete nearly one-half of the entire number of piles had been driven. As the material through which the piles were being driven changed continually, it was thought advisable to have some additional borings made for the purpose of obtaining more accurate information in regard to the underlying strata than was obtained by those previously taken at greater intervals. An agreement was therefore made with Gow & Palmer on Nov. 6, 1905, for making additional borings, as required, at a price of \$0.65 per linear foot. Under this agreement 54 borings were made under the Lock to a total depth of 1,776.8 feet, and 29 borings were made under the sluices to a total depth of 809.4 feet.

Under the toe of the side walls of the Lock the piles were spaced 2 feet 6 inches on centers, in rows 21 inches apart, the piles in the adjacent rows being staggered. It was anticipated that this close spacing might compact the earth so that it would be difficult to drive the piles, but no trouble of this nature was found. On starting work, the piles under the front of the wall

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 THE RIVER BASIN COMMISSION  
 The  
 was driven deep; but it was soon noticed that as the piles  
 the water was being driven, the piles under the lower part  
 were being pushed out towards the center of the Lock, in some  
 places the movement being as much as 2 1/2 feet. Afterward  
 the heads were driven firm, and from that time on no further  
 movement of the piles towards the center of the Lock was

observed.

It was also noted in driving the piles that in some places the  
 piles would rise from 2 to 4 inches after being driven, and the  
 water was compressed around them by the driving of the piles.  
 (Observations were taken on account of this pile to  
 determine the amount and direction of this movement, and to  
 see if the rising of the piles left them less firmly fastened in;  
 but this phenomenon on subsiding was found practically identical  
 with that on the original driving.

At the upper end of the Lock and under the upper gate  
 where a very firm and hard bottom was found, composed of  
 soft gravel, and in one place of a very fine sand and gravel  
 mixed with a little clay, through which it would have been im-  
 possible to drive spruce piles; and, as the borings showed rock  
 at a distance of from 6 to 10 feet lower, tests were made to see  
 if there could be any settlement under the anticipated loads.  
 A 12 inch cube of long leaf yellow pine was placed on a care-  
 fully leveled surface and on top of this cube was placed a casting  
 weighing 4 tons. Daily elevations were then taken on this cast-  
 ing for a period of two weeks, during which time it remained  
 practically stationary and showed no sign of settlement. It  
 was then decided to place the upper end of the Lock directly on  
 the hard bottom except on the westerly side of the Lock, where  
 piles were driven 2 feet and up in length.

A pile near the lower end of the Lock was tested by the use  
 of one 15 tons of pile load loaded on a platform built on the  
 top of a pile with the following results: —

Pile loaded,	Jan. 25.
Load observed,	" 27, .015 foot.
Settlement observed,	Feb. 3, .024 foot.
Settlement observed,	" 10, .024 foot.
Settlement observed,	" 17, .024 foot.
Settlement observed,	" 19, <sup>1</sup> .024 foot.

<sup>1</sup> Test abandoned.



It was thought that this slight change was probably due to the compression of the fibers, and that the pile would safely support a load of 15 tons without movement.

Two lines of 6-inch spruce or yellow pine sheeting were driven underneath the Lock, to prevent the passage of water along the bottom of the concrete, one under the lower gate recess and across the Lock opposite same, and one about half way up the Lock, to be connected later with the shut-off dam on the westerly side of the Lock. A third line of cut-off sheeting was also shown on the contract plans under the upper gate recess; but the bottom was so hard at this point that the sheeting, as well as the foundation piles, was omitted, except the foundation piles under the westerly side wall.

#### *Concrete Masonry at the Lock.*

This work is included in Contract No. 1, with the Holbrook, Cabot & Rollins Corporation. Gravel from the harbor and from Shirley Gut was brought up by scows and dumped in the river bed at the lower end of the coffer-dam. From there it was raised by a rehandler operating an orange peel bucket to an elevated hopper 16 feet by 14 feet, with its top about 70 feet above the bottom of the Lock. From this hopper the material passed over four screens set at an angle of 1 to 12, which separated the material into the sand and stones, which were deposited in storage bins of 120 and 200 cubic yards capacity. Below the storage bins were the measuring hoppers for getting the proper quantity of sand and gravel. After leaving the measuring hoppers, the sand and gravel passed to a 24-inch belt conveyor about 90 feet long, which carried the mixture, together with the proper amount of cement, to a hopper directly over a cubical mixer holding a little over 2 cubic yards. From the cubical mixer the concrete was dumped into boxes holding about 2 cubic yards, mounted on trucks running on a track and operated by an endless cable. The boxes were of the bottom-dumping type, the doors automatically locking when replaced empty upon the car trucks.

The concrete boxes were handled by a movable bull-wheel derrick mounted on a platform at the elevation of the top of the Lock walls, and carried on wheels running on rails laid on

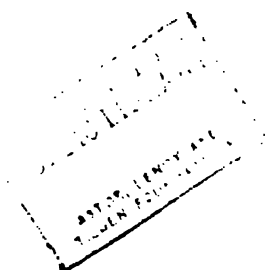
heavy timbers on each side of the Lock. The forms for the side walls of the Lock were 40 feet long and about 30 feet high, and were built of 3-inch plank placed one side to even thickness. These side wall forms were hung from a traveler 30 feet high and 40 feet long, running in advance of the movable derrick on the same rails, and were placed in position by means of jacks and other bracing, as the case required.

The specifications provided that the Lock should be built in sections not exceeding 40 feet in length, and the ends of the sections were to have an offset or projection 6 inches in width, to form a water-stop. The ends of these sections were covered with two layers of tar paper applied with a hot mixture of coal-tar pitch, which was first spread over the surface of the concrete, then between the layers of tar paper, and finally over the entire surface of the tar paper joint.

The sequence of operations in concreting one section of the Lock was as follows: first, the excavation was completed to the proper grade; then the piles were cut off and the bottom set of twisted steel rods,  $\frac{3}{4}$  of an inch in diameter and 11 inches on centers, was placed in position; then the concrete mixed in the proportion of 1: 3: 6 was brought up in level layers about 1 foot thick to within a foot of the top of the bottom of the Lock; then the top set of  $1\frac{1}{4}$  inch diameter twisted steel rods, 8 inches on centers, was placed 6 inches below the finished surface, and the top 12 inches of 1:  $2\frac{1}{2}$ : 5 concrete brought to the finished surface; then the forms for the slope at the foot of the side walls, rising 2 feet vertically in  $3\frac{1}{2}$  feet horizontal, were set and the concrete brought up to the top of the slope. After this concrete was set, the high side wall forms, 40 feet long by 30 feet high, were set and braced in position, after which the side walls were brought up in horizontal layers, care being taken to keep the opposite sides at about the same elevation. It required some ten days to complete a 40-foot section of side walls after the bottom section was put in, and some two days more to move the high forms ahead and set them in position for the next section. The question of the proper mixture and thickness to use for the facing of the side walls of the Lock required considerable attention, and a series of experiments was made to determine what proportions made the most impermeable concrete.



LOCK — EXPANSION JOINTS.

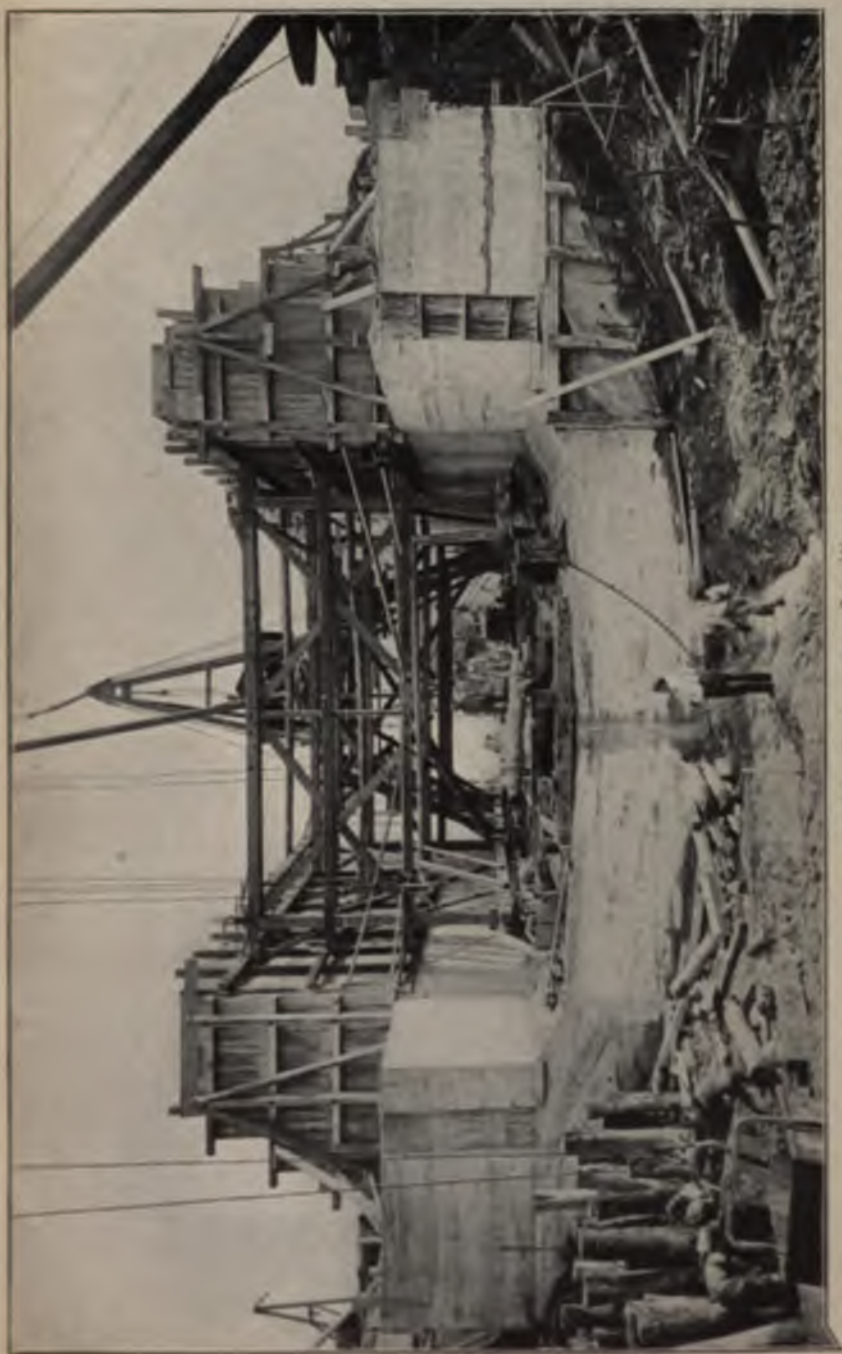




LOCK - BOTTOM COMPLETED.







LOCK - CONSTRUCTING SIDE WALLS





LOCK—LOOKING DOWN-STREAM.

THE NEW YORK  
PUBLIC LIBRARY

ASTOR, LENOX AND  
TILDEN FOUNDATION





LOCK—LOWER GATE RISING



From the results of the experiments, and from what information was obtained by correspondence and from published reports, it was decided to use a layer 6 inches thick for the facing, composed of 1:1:2 concrete. This was changed to a mortar of 1:3, after the results of further experiments were made known. This facing was carried up with the other concrete for the side walls, the 6-inch space being maintained by means of a steel diaphragm 12 inches high and about 10 feet long, with spacers 6 inches long at each end and one in the middle to keep a uniform distance from the forms. As soon as the facing was placed, the diaphragm was removed and the mortar and backing spaded together to make sure of a good bond, and strips of No. 16 gage, 3-inch mesh, expanded metal, 12 inches wide, were placed horizontally in the soft concrete 1 foot apart vertically above elevation 98 and 2 feet apart below that elevation, in order to prevent the facing from separating from the main portion of the wall.

At the end of the period covered by this report, some 28,500 cubic yards of concrete had been placed in the Lock and Boston Marginal Conduit under Contract No. 1.

#### *Lock-gates.*

The detail drawings for the Lock-gates, which were being prepared at the beginning of the period covered by this report, were completed and a contract for the construction of the gates made with the New Jersey-West Virginia Bridge Company. Most of the material for the Lock-gates was rolled and delivered to the contractor, but no shop work was done. It was deemed advisable to furnish the axles for the Lock-gate trucks, with the wheels mounted upon them, to the contractor, and contracts were made with The William Cramp & Sons Ship and Engine Building Company for furnishing the manganese bronze axles, and with the Griffin Wheel Company for furnishing chilled cast-iron wheels and mounting them. The use of manganese bronze for the axles was thought best, as this metal, while possessing all the physical properties of structural steel, does not deteriorate in salt water. The strength of the axles will, therefore, not decrease as would the strength of steel axles, and there will be no possibility of rust preventing them from turn-

— — —

1.                           2.                           3.                     

1.                      2.                      3.                     

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[illegible]

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Figure 1. Schematic representation of the experimental design. The subjects were divided into two groups: the control group (CG) and the experimental group (EG). The CG was divided into two subgroups: the control group (CG) and the control group (CG). The EG was divided into two subgroups: the experimental group (EG) and the experimental group (EG). The CG was divided into two subgroups: the control group (CG) and the control group (CG). The EG was divided into two subgroups: the experimental group (EG) and the experimental group (EG).

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*Other Metal at the Lock.*

The structural steel work for supporting the roof over the Boston Marginal Conduit outlet chamber, and special castings for supporting the operating machinery for the Lock-gates, have been designed.

Steel for reenforcing the concrete; the adjustable bearings for the Lock-gates, manhole frames and covers; anchorages for holding Lock-gate bearing timbers in place in the masonry; bed-plates for operating machinery; cast-iron pipes for suction and discharge from the pumps, for the conduit under the Lock and for the gage pipes; and the wrought-iron pipes for the electric ducts have nearly all been placed in the masonry.

*Heating Plant.*

The design of the heating system, which is intended to prevent the formation of ice on the Lock-gates, was based on the experiments made at Mystic Lake during the winter of 1904-05, which were briefly described in the third annual report of the Commission.

Radiators of the size necessary to heat the parts of the gates on which ice may form are to be placed inside the Lock-gates, near the skin plates, and steam will be supplied to these, at the desired pressure, from main pipes laid along the tops of the gates.

The system of air piping to be installed is intended to make it possible for men to work comfortably inside the gates, as well as to supply, under pressure, the air necessary to allow the use of the air locks which give access at all times to the chambers about the trucks on which the gates run. These chambers, open at the bottom, work on the principle of the diving-bell, the pressure of the air inside being sufficient to keep the water from rising, and make it possible not only to get at the trucks at any time, but, by moving the gate slowly, to make an examination of the track without pumping out the Lock-gate recess.

A contract was made with The Lumsden & Van Stone Company for furnishing and erecting in the Lock-gates steam, water and air piping, together with all necessary fittings and hangers.

Complete detail plans for the boiler plant necessary for fur-



nishing steam for heating the Lock-gates, the houses over the Lock-gate recesses, and the gate-house at the sluices, were not made, as it was thought advisable to allow bidders to submit designs with their proposals; but the desired general arrangement was shown, and a table of general data was given in the specifications.

The plant is to consist of two horizontal return tubular boilers, 48 inches in diameter and about 16 feet long, designed to work at a pressure of 125 pounds per square inch, using anthracite coal for fuel and with an induced draft; together with settings, grates, fronts, feed and blow-off piping, gages, uptakes, dampers, flue and all other details necessary.

A contract was made with Lynch & Woodward for furnishing and erecting this plant complete and ready to generate steam.

#### *Superstructures.*

The studies for the superstructures over the two Lock-gates were continued, and sketches were completed of the one over the lower Lock-gate recess in its final form. Studies are in progress of the one over the upper Lock-gate recess.

#### *Drawbridge.*

As stated in the third annual report of the Commission, a contract was made on Aug. 25, 1905, with The Scherzer Rolling Lift Bridge Company, for the design of a single-leaf, two-part drawbridge of their patented type. The plans submitted by them, twelve in number, were checked, and a contract, based on them, was made with the American Bridge Company of New York for the construction of the bridge. This company prepared forty shop plans, which were carefully examined by The Scherzer Rolling Lift Bridge Company and by one of the engineers of the Commission before being approved by the Chief Engineer, and no work of construction was allowed until such approval had been given. Most of the material for this bridge, ready for erection, has been delivered at the site of the work. The substructure material, to be placed by the Commission, has been erected for the southerly half of the bridge.

*Cambridge Cofferdam.*

The design for this coffer-dam, being constructed by the Holbrook, Cabot & Rollins Corporation under Contract No. 1, was modified in a similar way to that of the Boston coffer-dam, the only difference being in the earth slopes, which in this dam, on the outside, were carried up to elevation 110, and on the inside had a berm 10 feet wide at elevation 110, except on the westerly side, which had a berm 15 feet to 20 feet wide in different places. The original plans for this coffer-dam showed the up-stream and down-stream ends carried through the old sea-wall into good material, with a by-pass built to take the flow from the Bridge Street sewer; but on request of the contractor this was modified, so that the entire structure was built complete outside of the sea-wall, on condition of his agreeing to keep the outlet of the Bridge Street sewer open and to make the permanent connection therewith at the proper time.

In order to avoid any trouble from sliding banks when the coffer-dam was being pumped out, most of the silt enclosed by the inside line of sheeting was dredged out before the coffer-dam was closed. The piles on each side of the different rows of cut-off sheeting were not driven until after the coffer-dam was pumped out and the cut-off sheeting was driven, as some of these piles might have interfered with driving the sheeting. .

*Sluices.*

Contract plans for timber sluice-gates for the sluices near the Cambridge end of the Dam were prepared early in the year; but as only one proposal for the work was received, and that at what was considered an excessively high price, it was decided to use metal sluice-gates, and contracts were made with the Coffin Valve Company for furnishing and erecting them.

As the sluices are less than 100 feet long, whereas the Dam is in general from 350 to 500 feet in width, it was very essential that every precaution should be taken to make sure that the water could not make a channel under them; therefore, four lines of cut-off sheeting were driven. Underneath the sluices was found a layer of gravel from 4 to 6 feet thick, through which it was impossible to drive the sheeting piles

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SLUICES — WESTERLY PORTION.





every 100 feet, to which could be attached a 2½-inch fire hose in case of the bridge getting on fire. No occasion has arisen for its use, however, since it was installed.

The draw has been operated without any serious delays to traffic over it during the fourteen months. The longest time it was closed to street travel was on Dec. 12, 1905, from 11.15 A.M. to 1.30 P.M. This was caused by the boom of a lighter, while passing through the draw, striking the trolley wires and causing a short circuit of the current, so that there was no power to operate the motors until after repairs could be made.

#### BOSTON MARGINAL CONDUIT AND BOSTON EMBANKMENT.

The construction of the Boston Embankment by the Commission having been authorized by the General Court, plans and specifications for two sections were prepared and contracts made for this work, in connection with which the Boston Marginal Conduit will be constructed.

The first of these sections, known as Section 3 of the Boston Marginal Conduit and Section 1 of the Boston Embankment, extends from the Cambridge Bridge to a point between Berkeley and Clarendon streets, a distance of about 2,700 feet. It requires about 360,000 cubic yards of earth filling, 200,000 linear feet of piles, 6,300 cubic yards of concrete masonry and 900 cubic yards of stone masonry. Coleman Brothers, of Boston, were the lowest bidders for this section, and a contract for the work was made with them.

The second section, known as Section 4 of the Boston Marginal Conduit and Section 2 of the Boston Embankment, extends from the end of the section described above, between Berkeley and Clarendon streets, to a point between Fairfield and Gloucester streets. It requires about 145,000 cubic yards of earth filling, 170,000 linear feet of piles, 5,700 cubic yards of concrete masonry and 900 cubic yards of stone masonry. The Holbrook, Cabot & Rollins Corporation, of Boston, was the lowest bidder for this section, and a contract for the work was made with that company.

Plans and specifications for the next section, to be known as Section 5 of the Boston Marginal Conduit and Section 3 of the Boston Embankment, were being prepared at the end of



broken stone filling in the rear of the wall acted as an open drain to bring the water of the river into the trench, and it was soon found that work could be done here only at low water. But work was pushed day and night, including Sundays, at low water, until October 24, when, after 70 feet of conduit had been completed, work was suspended at the request of the city engineer of Boston, and nothing further was done here until November 15. During this interval the work was carried on vigorously through the women's gymnasium and playground, and the crossing of the Fruit Street overflow was successfully accomplished. At Fruit Street a second overflow was found below the one in use, with its invert at elevation 100-. This lower overflow brought considerable water into the trench, but after the openings on each side of the trench were filled with sand bags and bulkheaded off, little further trouble was found.

Early in November excavating was started for the overflow chamber and conduit, and a bull-wheel derrick with a 60-foot boom was set up to handle the excavation and the heavy iron troughs which were to be placed in the chamber. During November and December the work on the overflow chamber and conduit was continued, and on the last day of December the last pile was driven under this contract. The 60-inch pipe at the end of the overflow conduit was put in place December 27, and the work of smoothing up the interior surface of the overflow conduit and calking the leaks was continued. Work was resumed at Cambridge Street on November 15, and an effort was made to complete the conduit beyond the southerly line of the approach to the new Cambridge bridge. In order to hasten the progress of the work at this point, 3-inch splined sheeting was furnished the contractor by the Commission. The interior finish of the conduit consisted of a skim coat on the invert and a cement wash on the side walls and arch. This gave satisfactory results. Some leaks developed, probably due to contraction of the masonry; but these were all made tight, the worst of them by cutting out a small groove from 1 inch to 1½ inches deep, and then calking into the groove soft "tea lead," after which it was plastered with neat cement in the usual manner. The elevation of the invert of the conduit is about 2.0 feet below mean low water, and the ground water stands at all times above

the top of the arch; but from the time the pumping was stopped, in February, 1906, until Nov. 30, 1906, the leakage into the conduit only filled it to a depth of 14 inches.

On Section 3 of the Boston Marginal Conduit and Section 1 of the Boston Embankment, being constructed by Coleman Brothers, under Contract No. 44, filling has been in progress from the shore at Revere Street, Cambridge Street, and some 100 feet east of Otter Street. Over 10,000 cubic yards have been deposited in this way.

About 50 feet of completed conduit have been built, and some 30 feet more of trench were nearly down to grade. The contractor desired to make use of the Blaw Collapsible Steel centers, and he was given permission to give them a trial. Piles have been driven for the conduit for a distance of nearly 1,000 feet, but the contractor has been requested not to drive any more piles until the results of filling over the piles already driven can be noted, as there is a possibility that the piles may move while the filling is going on. Excavating sand and gravel with a dredge and depositing it under the line of the proposed Basin wall and excavating ordinary earth and depositing it in the embankment have been in progress.

The filling near the West Boston temporary bridge pushed out some of the piles at the up-stream end of the bents of the bridge, and caused a settlement of the sidewalk and roadway during the week beginning November 19; and on Saturday, November 24, a portion of the up-stream half of the roadway was fenced off to public traffic, and a close watch was kept on the rest of the bridge at that point. On Tuesday, November 27, however, traffic was diverted to the new Cambridge bridge.

On Section 4 of the Boston Marginal Conduit and Section 2 of the Boston Embankment, being constructed by the Holbrook, Cabot & Rollins Corporation, under Contract No. 50, a dredge has been used to excavate sand and gravel and deposit it for a dike under the line of the proposed Basin wall. Up to the end of the year some 5,000 cubic yards of material have been excavated and deposited under or adjacent to the line of the Basin wall at the lower end of the section.

On Feb. 5, 1906, after being in operation nearly two years, all of the recording gages that had been placed on the sewer





BOSTON MARGINAL CONDUIT - CAST-IRON OVERFLOW.





overflows on the Boston side of the river, between Brimmer Street and St. Mary's Street, were abandoned, except the one at the junction of Beaver and Beacon streets. In order to obtain a partial record of the heights to which the sewage is backed up in the sewers at times of high tide, whitewashed laths were substituted for these gages in the various manholes, and observations were taken of the high-water marks shown on the laths, by weekly inspections or whenever a storm of sufficient magnitude to cause an overflow occurred. The gage at Beaver Street has been continued, because it shows the approximate elevation of the sewage in the west side interceptor, being located in a manhole having a free connection with the interceptor through a 16-inch pipe and only 8 feet distant from the interceptor.

#### DREDGING IN THE BASIN.

Some 60,000 cubic yards of material were dredged from the Basin, under Contract No. 1, with the Holbrook, Cabot & Rollins Corporation, in front of property on the northwesterly side of the river below Broad Canal, the greater portion of this material being deposited in Section 1 of the Boston Embankment.

#### BROAD AND LECHMERE CANALS.

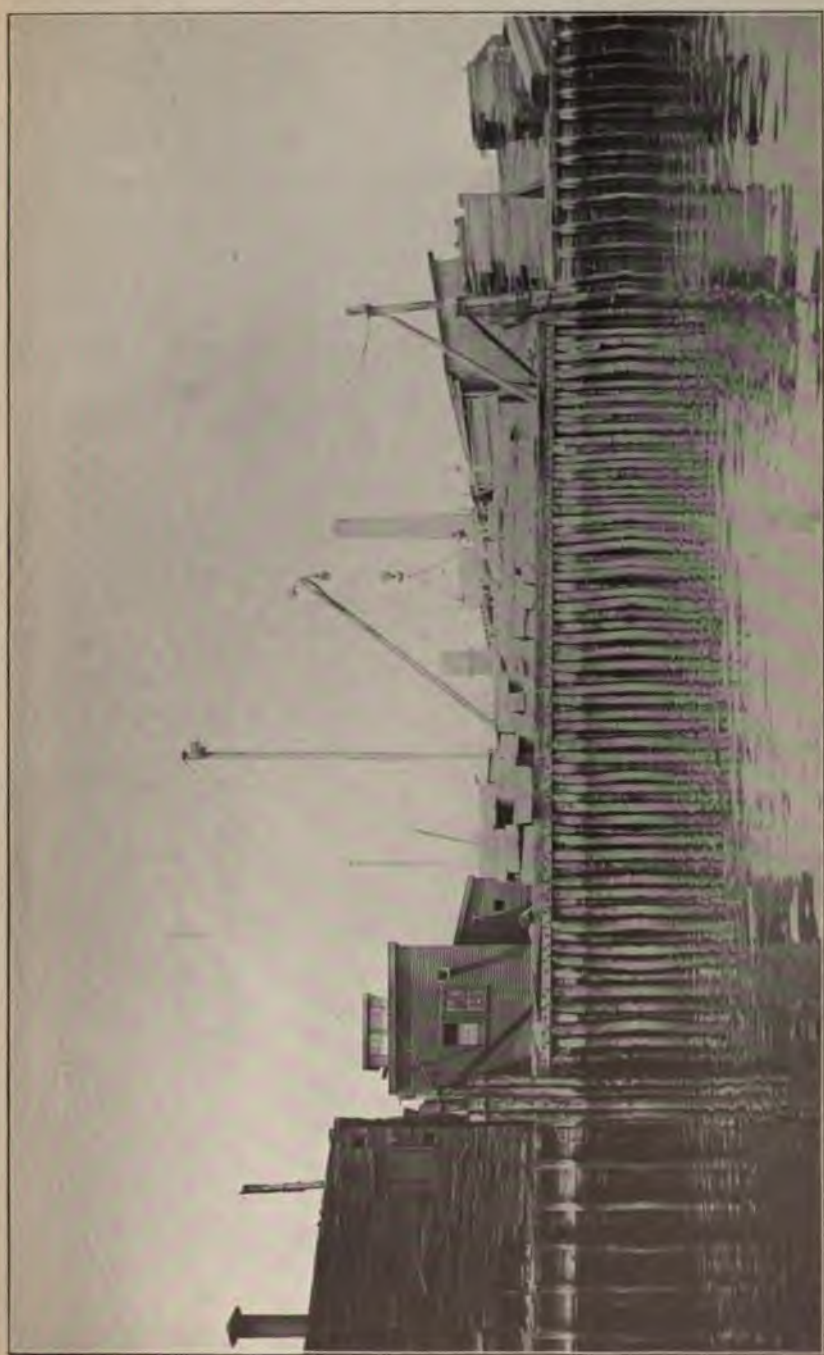
Section 4 of chapter 465 of the Acts of 1903 provided that before the Dam was completed the dredging in the canals should be done, and the walls or wharves should be strengthened by driving in front of said walls or wharves prime oak piles 2 feet on centers. This work has been prosecuted by the Holbrook, Cabot & Rollins Corporation, under Contracts Nos. 1 and 23. As soon as piles were received the contractor began the work of driving them. At first the piles were driven 4 feet on centers, in order to allow the use of the ordinary pile-driver, as the side of the gins prevented the piles from being spaced as closely as 2 feet on centers. Later on, however, all of the piles were driven with an outrigger, and by this means were driven 2 feet on centers without any difficulty. Before driving piles in front of any of the properties fronting on the Basin and the canals, releases from damages were secured from the owners.

At the end of the period covered by this report the pile-driving was completed as follows: in Broad Canal, at all places on the northerly side except at Connery & Wentworth's and at portions of the properties of Warren Brothers Company and Reuben Sherburne, where there is neither wall nor bulkhead; in Broad Canal, on the south side, at all places except in front of the properties of the city of Cambridge, Charles A. Morse, John J. Horgan, heirs of Howard Cocom, estate of Willard Dalrymple, Matthews & Fay, Sylvester Tower Company, and the portion of the Geo. G. Page Box Company property above the railroad bridge; in Lechmere Canal the piles are driven except in front of properties of the Wellington-Wild Coal Company, the Linehan estate, a portion of the Peters estate, Charles E. Hall & Co., and John T. Scully.

Some 20,000 cubic yards of material were excavated in Broad Canal, the greater portion of which was deposited in Section 1 of the Boston Embankment.

Prior to beginning dredging in Broad Canal, an effort was made, but without success, to come to some agreement with the abutters, by which the dredging could be done on certain days of the week, and on the other days leave the canal free for the movement of vessels up and down the canal.

While dredging was in progress, on September 10, the barge "Devon," on its way up the canal, grounded on the southerly side of the canal at a point about opposite the property of the Consumers' Coal Company, and was unable to get off until September 15. During this week another effort was made to come to some agreement with the towboat companies and coal companies as to the method and time for doing the dredging, but without result. On October 5 another conference was held between the dredging contractor and the coal companies having wharves along Broad Canal, but no satisfactory solution was reached. During the latter part of the month of October the Commission notified the property owners and towboat companies that the Commission would begin dredging Broad Canal on November 1, and that the canal would be closed to traffic while dredging was going on, and would continue the work until such time as the Commission thought it safe for traffic to be resumed. Dredging was resumed in Broad Canal on No-



LECHMERE CANAL — AFTER DRIVING PRIME OAK PILES.

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ASTOR, LENOX AND  
TILDEN FOUNDATIONS



vember 1, and was continued day and night with only slight interruptions to the end of the period covered by this report; the work was then completed to within 400 feet of the Third Street draw.

#### LAND TAKINGS.

A taking plan was made of land along the Boston shore of the Charles River from the Cambridge Bridge to Charlesgate West.

#### UPLAND FLOW OF THE CHARLES RIVER.

A recording gage, showing the depth of water flowing over the dam at the Waltham Bleachery, was maintained, and weekly current meter observations were taken of the flow in the canal past the Bleachery Dam.

Table No. 1 shows the estimated average flow of the Charles River at the Waltham Bleachery for weekly periods. The area of the watershed above the Waltham Bleachery is taken to be 169 square miles; this excludes 70 square miles assumed to be tributary to Mother Brook and 24 square miles tributary to the Cambridge reservoirs. Whenever these reservoirs overflowed into the Charles, the amount, as furnished by Mr. L. M. Hastings, city engineer of Cambridge, has been deducted from the total discharge measured at the Waltham Bleachery.

Table No. 2 shows the number of days during the period covered by this report when the upland flow of the Charles River at the site of the Dam, estimated from the records kept by the Charles River Basin Commission at the Waltham Bleachery, was more than 500 cubic feet per second for twenty-four hours.

Table No. 3 shows the length of time during which a normal tide will be higher than the water in the Basin, and the rise of the Basin during that interval for various rates of upland flow.

Diagram No. 1 shows the daily flow of the Charles River at the Waltham Bleachery, in connection with the rainfall at Chestnut Hill, taken from the records of the Metropolitan Water Works.

TABLE NO. 1.—*Estimated Weekly Average Flow of Charles River at the Waltham Bleachery, Sept. 30, 1905, to Nov. 30, 1906.*

WEEK ENDING—	Cubic Feet per Second.	Cubic Feet per Second per Square Mile. <sup>1</sup>	WEEK ENDING—	Cubic Feet per Second.	Cubic Feet per Second per Square Mile. <sup>1</sup>
<b>1905.</b>			<b>1906.</b>		
Oct. 7, . . . .	107	.64	May 5, . . . .	287	1.70
14, . . . .	57	.34	12, . . . .	302	1.79
21, . . . .	45	.27	19, . . . .	238	1.40
28, . . . .	101	.60	26, . . . .	153	.91
Nov. 4, . . . .	69	.41	June 2, . . . .	225	1.33
11, . . . .	67	.40	9, . . . .	336	1.99
18, . . . .	93	.54	16, . . . .	204	1.21
25, . . . .	73	.43	23, . . . .	158	.94
Dec. 2, . . . .	84	.50	30, . . . .	121	.72
9, . . . .	155	.92	July 7, . . . .	133	.79
16, . . . .	165	.98	14, . . . .	164	.97
23, . . . .	136	.80	21, . . . .	127	.75
30, . . . .	218	1.29	28, . . . .	134	.79
<b>1906.</b>			Aug. 4, . . . .	106	.63
Jan. 6, . . . .	238	1.41	11, . . . .	108	.64
13, . . . .	245	1.44	18, . . . .	162	.96
20, . . . .	248	1.47	25, . . . .	152	.90
27, . . . .	323	1.91	Sept. 1, . . . .	114	.67
Feb. 3, . . . .	306	1.81	8, . . . .	68	.40
10, . . . .	174	1.03	15, . . . .	53	.31
17, . . . .	169	1.00	22, . . . .	23	.14
24, . . . .	253	1.50	29, . . . .	70	.41
Mar. 3, . . . .	406	2.40	Oct. 6, . . . .	106	.63
10, . . . .	567	3.36	13, . . . .	93	.55
17, . . . .	561	3.32	20, . . . .	110	.65
24, . . . .	372	2.20	27, . . . .	152	.90
31, . . . .	440	2.60	Nov. 3, . . . .	218	1.29
Apr. 7, . . . .	600	3.55	10, . . . .	166	.98
14, . . . .	518	3.07	17, . . . .	169	1.00
21, . . . .	514	3.04	24, . . . .	221	1.30
28, . . . .	372	2.20	Dec. 1, . . . .	181	1.07

<sup>1</sup> Area of watershed is 169 square miles.

**TABLE NO. 2.—** *Number of Days from Sept. 30, 1905, to Nov. 30, 1906, when Estimated Upland Flow of Charles River at the Site of the Dam was More than 500 Cubic Feet per Second for Twenty-four Hours, from Records kept by the Charles River Basin Commission at the Waltham Bleachery.*

MONTH.	500-750 Cubic Feet per Second (Days).	750-1,000 Cubic Feet per Second (Days).	1,000-1,500 Cubic Feet per Second (Days).	1,500-2,000 Cubic Feet per Second (Days).	2,000-2,500 Cubic Feet per Second (Days).	Total Number of Days, exceeding 500 Cubic Feet per Second.	Rainfall at Chestnut Hill (Inches).	Average Rainfall on Sudbury Watershed for Thirty-one Years (Inches).
<b>1905.</b>								
October, . . .	-	-	-	-	-	-	1.53	4.14
November, . . .	-	-	-	-	-	-	2.51	3.89
December, . . .	-	-	-	-	-	-	4.27	3.82
<b>1906.</b>								
January, . . .	1	-	-	-	-	1	3.65	4.24
February, . . .	5	-	-	-	-	5	3.17	4.27
March, . . .	9	14	-	-	-	23	7.42	4.55
April, . . .	12	12	-	-	-	24	2.62	3.58
May, . . .	-	-	-	-	-	-	5.43	3.28
June, . . .	2	-	-	-	-	2	3.56	3.15
July, . . .	-	-	-	-	-	-	4.13	3.73
August, . . .	-	-	-	-	-	-	1.82	4.01
September, . . .	-	-	-	-	-	-	2.92	3.43
October, . . .	-	-	-	-	-	-	3.71	4.14
November, . . .	-	-	-	-	-	-	3.37	3.89
Totals, <sup>1</sup> . . .	29	26	-	-	-	55	50.11	54.12
1904-05, <sup>2</sup> . . .	21	25	5	-	-	51	-	-
1903-04, <sup>2</sup> . . .	29	18	13	5	1	66	-	-

<sup>1</sup> 14 months.

<sup>2</sup> One year.

The flow at the site of the Dam was obtained from that at the Waltham Bleachery by applying the yield per square mile given in Table No. 1 and adding the waste from the Cambridge reservoirs watershed as obtained from the records kept by the city of Cambridge.

TABLE NO. 3. — *Time during which a Normal Tide will be Above the Water in the Basin, and Rise of Basin during that Interval for Various Rates of Upland Flow.*

Rate of Upland Flow (Cubic Feet per Second),	Time Harbor will be Above Basin.		Rise of Basin (Feet).	Rate of Upland Flow (Cubic Feet per Second),	Time Harbor will be Above Basin.		Rise of Basin (Feet).
	Hrs.	Min.			Hrs.	Min.	
500	3	48	.29	3,000	3	19	1.02
1,000	3	42	.39	4,000	3	8	1.28
1,500	3	36	.56	5,000	2	58	1.51
2,000	3	30	.72	6,000	2	49	1.71
2,500	3	25	.87				

TRAFFIC THROUGH DRAW OF CRAIGIE BRIDGE AND OF  
TEMPORARY BRIDGE.

A record has been kept of the traffic through the draw of the temporary bridge. This record gives the tonnage, draft and time of passage of vessels of different kinds. Some of the results of the records obtained are shown by the following diagrams:—

Diagram No. 2 shows weekly totals of cargoes, in tons, not including the material furnished for the Charles River Dam, passing through the temporary bridge for the period included in this report.

Diagram No. 3 shows the monthly totals of cargoes, in tons, not including the material furnished for the Charles River Dam, passing through Craigie Bridge or the temporary bridge since Nov. 30, 1899. This diagram indicates a general tendency of the tonnage to decrease from year to year.

Diagram No. 4 shows the yearly number of vessels passing through Craigie Bridge or the temporary bridge since Sept. 30, 1885, and the number of times the draw has been opened per year since Sept. 30, 1871, the only complete years covered by existing records.

## MISCELLANEOUS ENGINEERING WORK.

One hundred and sixty-three finished plans were made during the period covered by this report, in addition to numerous studies and sketches. Two hundred and sixty-one plans were





Piles were driven for the foundation of Section 1 of the Boston Marginal Conduit during January, February and March, 1906, but the concrete structure was not started until during the month of July, when work was commenced on the portion immediately east of the lower gate recess.

On April 3, 1906, the first concrete was laid under the lower gate recess, and since that date concreting has been continuously in progress, so that at the end of the period covered by this report all that remains to be done is a little concrete at the outlets of the Boston Marginal Conduit, and a short section of the Boston Marginal Conduit above the upper gate recess where connection is to be made with Section 2 of the Boston Marginal Conduit built by James Driscoll & Son, under Contract No. 3.

In January, February and March, 1906, the piles under the sluices were being driven by a water machine with extension gins.

On June 23, 1906, the pumping out of the Cambridge coffer-dam was started, with water at elevation 101.5. On June 25 the water was at elevation 97.5, and on June 27 the pumping out was finished and trenches were being dug to conduct the water to the pump-well. Grading off the fill over the tops of the piles was immediately started, and as fast as possible the tops of the piles were sawed off to grade.

The driving of the cut-off sheeting at the sluices was started on July 11, and the four lines were completed on August 1, except for the portions that were outside the walls of the sluices.

Dredging was started at the entrance to Broad Canal on August 25, and was continued with only short interruptions from that date until the end of the period covered by this report.

The total value of the work performed, as shown by the November, 1906, estimate, was \$468,709.83, the principal items of which were as follows:—

Coffer-dam at the Boston end, . . . . .	85 per cent. completed.
Coffer-dam at the Cambridge end, . . . . .	85 per cent. completed.
Earth excavation, . . . . .	295,378 cu. yds.
Round piles in place (exclusive of coffer-dams), . . . . .	282,234 lin. ft.
Brace lumber in place, . . . . .	131 M. ft. B. M.
Concrete masonry, . . . . .	31,700 cu. yds.
Asphaltic surfacing, . . . . .	330 sq. yds.

Ashlar masonry, . . . . .	113 cu. yds.
Dimension stone masonry, . . . . .	63 cu. yds.
Face dressing, . . . . .	1,400 sq. ft.
Iron and other metal work placed, . . . . .	527 tons.
Special work, . . . . .	\$1,232.73
Extra work, . . . . .	54,077.24

*Contract No. 2, United States Wood Preserving Company. —  
Wooden Block Paving for Temporary Bridge, Boston and  
Cambridge.*

On March 23, 1905, a contract was made with the United States Wood Preserving Company for furnishing and laying the wooden block paving for the temporary bridge.

As no maintenance work was done by the contractors under their four years' maintenance guarantee, and the condition of the bridge was such that it was deemed necessary to replace a large portion of the blocks with spruce plank, no additional payments have been made under this contract.

*Contract No. 3, James Driscoll & Son. — Section 2 of the  
Boston Marginal Conduit, Boston.*

On June 13, 1905, a contract was made with James Driscoll & Son for the construction of the Boston Marginal Conduit between the Dam and the southerly side of Cambridge Street. A description of the work called for by this contract was given in the report for the year ending Sept. 30, 1905.

Work on this contract was continued, that in progress at Cambridge Street being suspended on October 24, at the request of the city engineer of Boston, and resumed again on November 15.

On December 11 the weather became so cold that it was found necessary to heat the sand, gravel and water, in order to lay concrete, and this was done most of the time until the completion of the work. On December 1 the work of finishing the interior of the conduit was started, and was continued, with occasional interruptions caused by accidents to the pumping plant, until the completion of the work on February 21.

The final estimate on this work was submitted June 30, 1906, amounting to \$52,383.10, the principal items being as follows:—

Earth excavation and refill (main conduit), . . . . .	1,803.90 lin. ft.
Earth excavation and refill (overflow conduit), . . . . .	172.10 lin. ft.
Rock excavation, . . . . .	233.19 cu. yds.
Piles, . . . . .	51,784.40 lin. ft.
Underdrain, . . . . .	1,976.10 lin. ft.
Concrete masonry, . . . . .	2,650.40 cu. yds.
Placing iron and other metal work, . . . . .	45.77 tons.
Sheeting left in place, . . . . .	56.60 M. ft. B. M.
Crossings of Fruit and Cambridge street overflows.	
Extra work, . . . . .	\$3,857.47

*Contract No. 4, Camden Iron Works. — Cast-iron Pipes and Special Castings, Boston and Cambridge.*

On July 18, 1905, a contract was made with the Camden Iron Works for a portion of the cast-iron pipes and specials to be embedded in and attached to the masonry in connection with the Dam and Lock and the Boston Marginal Conduit.

The final estimate on this contract was submitted on Jan. 22, 1906, amounting to \$5,833.86. The quantities in the final estimate were as follows:—

Straight pipe, of sizes varying from 6-inch to 60-inch, . . . . .	115.23 tons.
Standard special castings, . . . . .	16.39 tons.
<b>Special castings other than standard, . . . . .</b>	<b>23.72 tons.</b>

*Contract No. 5, Henry R. Worthington. — Furnishing and erecting Pumps, Boston and Cambridge.*

On Sept. 30, 1905, a contract was made with Henry R. Worthington for furnishing and erecting pumps. A description of the work called for under this contract is given in the report for the year ending Sept. 30, 1905.

These pumps and motors being completed in the shop, an estimate for 30 per cent. of the contract price, amounting to \$2,859.90, has been paid the contractor.

*Contract No. 6, Gibby Foundry Company. — Furnishing Castings and Other Metal, Boston and Cambridge.*

On July 27, 1905, a contract was made with the Gibby Foundry Company for the greater part of the special castings required for the Lock and Section 1 of the Boston Marginal Conduit.



The final estimate under this contract was submitted May 15, 1906, amounting to \$6,262.48. The principal items of the work were:—

Unfinished castings, . . . . .	29,079 pounds.
Finished iron castings, . . . . .	83,205 pounds.
Finished steel castings, . . . . .	5,254 pounds.
Rods, bolts, etc., . . . . .	6,373 pounds.

*Contract No. 23, Holbrook, Cabot & Rollins Corporation.—  
Furnishing, driving and capping Piles, Cambridge.*

On Dec. 4, 1905, a contract was made with the Holbrook, Cabot & Rollins Corporation for piles along the walls of the canals and Basin in Cambridge.

The work called for under this contract consisted in driving piles along the walls and wharves in Broad and Lechmere canals and the private property along the Cambridge side of the Basin between these canals, as provided in section 4 of chapter 465 of the Acts of 1903.

On Dec. 30, 1905, the first pile was driven in front of the property of the Rawson & Morrison Manufacturing Company, on the southerly side of Broad Canal.

The preliminary estimate of the work to be done under this contract was \$55,117.26. The value of the work done at the end of the period covered by this report, as shown by the November, 1906, estimate, was \$51,279.98. The principal items of work performed were as follows:—

Oak piles in place, . . . . .	3,122
Long-leaf yellow pine in place, . . . . .	71.4 M. ft. B. M.
Iron or steel in place, . . . . .	65,788 pounds.

*Contract No. 24, American Bridge Company of New York.—  
Constructing a Scherzer Rolling Lift Bridge, Boston.*

On March 5, 1906, bids were received for the construction of a Scherzer rolling lift bridge, and on March 16, 1906, a contract was made with the American Bridge Company of New York for the construction of this bridge for \$40,800.

This contract provides for the construction of a bridge 85 feet wide, with a span of some 50 feet. The bridge consists of

## *24. CHANES RIVER RACE COMMISSION. [Jan.*

*of Bridge Lock, opposite to Island, along toward the Commission dock. The contract calls for the erection of the bridge, complete with all the machinery, including electrical motor and appurtenances; it also requires the contractor to maintain the bridge for a period of twelve months after it has been completed.*

*In the case of the project covered by this report, nearly the whole of the material, except the electrical apparatus, for the bridge had been obtained, and nearly one-half of the material had been collected in the concrete by the Commission, acting through the Holliston, Cabot & Boston Corporation, the contractor under Contract No. 1.*

*The value of the work done at the end of the period covered by this report, as shown by the Foremaster, 1906, estimate, was \$1,659.05.*

### *Contract No. 25, Coffin Valve Company. — Furnishing Sluice-gates at the Sluices in the Dam, Cambridge.*

*On March 16, 1906, a contract was made with the Coffin Valve Company for the large gates for the sluices.*

*The contract calls for furnishing eight sluice-gates with clear openings of 7 feet 6 inches by 10 feet, with operating stands, motors, controllers and appurtenances. The gates, motors, etc., will be designed and proportioned to have ample strength, durability, stability and stiffness, and will be so arranged as to allow ample space for repairing, inspecting and adjusting. The contractor is also required to maintain the gates for two years.*

*A small amount of work was done under this contract and some of the anchor bolts were delivered. No payments were made. The amount of the contract was \$24,800.*

### *Contract No. 27, Coffin Valve Company. — Furnishing Sluice-gates on the Lock-gates in the Lock, Boston.*

*On March 6, 1906, a contract was made with the Coffin Valve Company for furnishing the sluice-gates on the lock-gates at the Lock, for the sum of \$17,000.*

*The work to be done under this contract consists in furnishing and setting on the Lock-gates fourteen sluice-gates to be used for Lock-filling gates, together with operating stands, motors, controllers and appurtenances.*



Considerable work has been done under this contract, but no material has been delivered and no payments have been made.

*Contract No. 28, Coffin Valve Company. — Furnishing Tide-gates at the Dam and Lock, Boston and Cambridge.*

On March 16, 1906, a contract was made with the Coffin Valve Company for furnishing and erecting twenty-five tide-gates at the Dam and Lock, the contract price for the gates being \$4,438, consisting of the following items:—

Item No. 1, Boston Marginal Conduit: 4 tide-gates without counterweights, . . . . .	\$687 00
Item No. 2, Boston Marginal Conduit: 5 tide-gates with counterweights, . . . . .	1,213 00
Item No. 3, Sluices: 4 tide-gates on a single frame, no counterweights, . . . . .	448 00
Item No. 4, Sluices: 7 tide-gates without counterweights, . . .	976 00
Item No. 5, Sluices: 5 tide-gates with counterweights, . . . .	1,114 00

The gates were delivered, and an estimate of \$2,662.80 was paid under the contract.

*Contract No. 30, New Jersey-West Virginia Bridge Company. — Constructing Lock-gates, Boston.*

On May 14, 1906, bids were opened for the construction of the rolling lock-gates in the Lock, and on June 13, 1906, the contract was awarded to the New Jersey-West Virginia Bridge Company for \$26,784.

The contract calls for the erection of two gates, some 47 feet long and 6 feet thick, the one at the lower end of the Lock to be some 31 feet high and the one at the upper end of the Lock about 26 feet high. The gates are of the nature of steel caissons, having water-tight compartments. The contract includes the furnishing of the trucks on which the gates rest, but does not include the furnishing of the wheels and axles.

The contract calls for the completion of the lower gate in the shop on Sept. 30, 1906, and of the upper gate on Oct. 30, 1906. A large portion of the material had been delivered in the shop, but at the end of the period covered by this report shop work had not been commenced.

*Contract No. 33, Chelmsford Foundry Company. — Furnishing Castings and Other Metal, Boston and Cambridge.*

On April 30, 1906, bids were opened for furnishing castings and other metal for use at the Dam and Lock, and on May 23, 1906, a contract was made with the Chelmsford Foundry Company for this material. The amount of this contract, on the basis of award, is \$2,025.10. The principal items called for under the contract were as follows:—

Iron castings, . . . . .	65,500 pounds.
Checkered steel plates, . . . . .	8,300 pounds.

The work has progressed very slowly, and has required a great deal of inspection. Although the contract called for its completion on July 22, 1906, at the end of the period covered by this report the contract was far from completion.

The total value of work done, consisting of 33,186 pounds of iron castings, as shown by the last estimate within the period covered by this report, was \$713.50.

*Contract No. 35, Gibby Foundry Company. — Furnishing Castings and Other Metal, Boston and Cambridge.*

Bids for the work to be performed under this contract were asked to be deposited May 24, 1906, and on May 29, 1906, the contract was placed with the Gibby Foundry Company. The amount of this contract, on the basis of award, is \$3,322.

The work consists of furnishing castings and other metal for use mainly at the Lock, including bollards and guide sheaves to be used in connection with the capstans in handling vessels in the Lock.

The principal items called for in the contract are as follows: some 50,000 pounds of iron castings and 18 bollards complete.

The contract provided that the material should be delivered within sixty days of the date of the contract, but the work progressed very slowly, and at the end of the period covered by this report a small amount still remained to be done.

The value of work completed, as shown by the October, 1906,

estimate, was \$2,644.32. The principal items of the work done were as follows:—

Iron castings, . . . . .	37,680 pounds.
Bollards, complete, . . . . .	18.

*Contract No. 37, American Ship Windlass Company. — Furnishing and erecting Electric Dock Capstans at Lock, Boston.*

On May 24, 1906, a contract was made with the American Ship Windlass Company for two capstans for warping vessels through the Lock.

This contract provided that the speed of the tow line should vary from 20 to 100 feet per minute, the maximum pull should be 5,000 pounds, and the maximum speed for the maximum pull should be 100 feet per minute.

The contract required that the capstans should be complete, with the electric motors and appurtenances, and that the contractor should maintain the capstans for two years.

Some of the anchor bolts to be furnished under this contract were delivered. No payments were made.

*Contract No. 38, Westinghouse Electric & Manufacturing Company. — Furnishing Motors for operating Lock-gates, Boston.*

Bids were received for four electric motors for operating the Lock-gates, and on May 25, 1906, a contract was made with the Westinghouse Electric and Manufacturing Company for these motors.

The contract provided that each motor should be 50 horsepower, railway type, series wound, complete with automatic solenoid brake.

The price called for in the contract was \$2,635.40.

The contract required the maintenance of these motors for two years.

*Contract No. 40, Chapman Valve Manufacturing Company. — Furnishing Plug Drain Valves, Boston.*

Bids were received for the material called for under this contract, and on June 7, 1906, the contract was placed with the Chapman Valve Manufacturing Company.



**Marginal Conduit.** On July 5, 1906, the contract was placed with the New England Structural Company for the sum of \$4,557.

The contract was completed and final settlement made.

*Contract No. 44, Coleman Brothers. — Section 3 of the Boston Marginal Conduit and Section 1 of the Boston Embankment, Boston.*

Bids were received under this contract Sept. 10, 1906, and the contract was signed on September 24.

The work under this contract extends from the southerly line of the new Cambridge Bridge to a point between Berkeley and Clarendon streets. It includes the marginal conduit, 2,700 feet long, with an overflow 140 feet long, a retaining wall 2,700 feet long, and connections with the several overflows from the sewer system of the city of Boston between those points, and an earth embankment from 100 to 300 feet in width between the present sea-wall and the proposed Basin wall.

The amount of the contract, on the basis of award, is \$232,700.

The principal items of the preliminary estimate were: —

Earth excavation and refill, . . . . .	160 lin. ft.
Earth filling, . . . . .	360,000 cu. yds.
Piles in place, . . . . .	207,000 lin. ft.
Drains, . . . . .	3,000 lin. ft.
Concrete masonry, . . . . .	6,300 cu. yds.
Asblar masonry, . . . . .	900 cu. yds.
Face dressing of pointed work, . . . . .	14,500 sq. ft.
Sheeting left in place, . . . . .	15 M. ft. B. M.
Yellow pine lumber in place in sewer outlets, . . . . .	35 M. ft. B. M.
Wrought iron and steel in place in sewer outlets, . . . . .	4,000 pounds.
Iron and other metal work to be placed, . . . . .	80 tons.

On Oct. 1, 1906, filling from carts was started at the foot of Revere Street, but on October 5 the filling was changed to a point in the rear of the old Eye and Ear Infirmary on Charles Street, near Cambridge Street. On October 22 filling from carts was begun at another point in the angle of the sea-wall on Back Street about 100 feet east of Otter Street.

Excavating for the conduit trench was started in the rear



of the Eye and Eye-Valve on October 12, and has since closed since that time with a small dam. Dredging was started on the same day. The work of placing concrete was started on November 5.

A bridge began work on October 21.

The total value of the work done, as shown by the September, 1906, estimate, was \$15,818.57.

Earth excavation and refill,	55 00 00
Earth filling,	32,342 00 yds
Piles in place,	32,342 00 ft
timber,	55 00 00
Concrete masonry,	25 00 00 yds

*Contract No. 46, Richard F. Keough. — Furnishing Small Boat Lock-gates, Cambridge.*

On Sept. 10, 1906, bids were opened for the four lock-gates for the small boat lock at the sluices, and on Sept. 17, 1906, a contract was made with Richard F. Keough for constructing these gates for the sum of \$850.

A small amount of work under this contract was done, but no payments were made.

*Contract No. 46, New England Structural Company. — Furnishing Structural Steel, Boston.*

On Sept. 17, 1906, bids were received for the structural material, consisting of steel beams for the Lock stop-planks, together with girders and trusses for supporting the same in the Lock, and other structural material required principally at the Lock. On Sept. 19, 1906, a contract for this material was placed with the New England Structural Company for \$7,380.

Very little material had been delivered under this contract at the end of the period covered by this report, and no payments had been made.

*Contract No. 48, The Lumsden & Van Stone Company. — Furnishing and erecting Steam, Water and Air Piping, Boston.*

On Oct. 15, 1906, bids were opened for this work, and on Oct. 20, 1906, a contract was made with The Lumsden & Van Stone Company for \$2,098.

The work called for under this contract consisted in furnishing and erecting the steam, water and air piping, with fittings and hangers, which is required inside the Lock-gates for heating, draining and ventilating them. No material has been delivered and no payments have been made.

*Contract No. 50, Holbrook, Cabot & Rollins Corporation. — Section 4 of the Boston Marginal Conduit and Section 2 of the Boston Embankment, Boston.*

Bids were received for this contract Oct. 29, 1906, and the contract was signed Nov. 5, 1906.

This contract covered the work of building Section 4 of the Boston Marginal Conduit and Section 2 of the Boston Embankment, and extends from a point between Berkeley and Clarendon streets to a point between Fairfield and Gloucester streets, a distance of about 2,400 feet.

The amount of this contract, on the basis of award, is \$198,890. The principal items of the preliminary estimate were: —

Earth filling, . . . . .	145,000 cu. yds.
Piles in place, . . . . .	172,000 lin. ft.
Drains, . . . . .	2,500 lin. ft.
Concrete masonry, . . . . .	5,700 cu. yds.
Ashlar masonry, . . . . .	900 cu. yds.
Face dressing of pointed work, . . . . .	14,500 sq. ft.
Yellow pine lumber in place in temporary sewer outlets, . . . . .	10 M. ft. B. M.
Wrought iron and steel in place in temporary sewer outlets, . . . . .	2,000 pounds.
Iron and other metal work to be placed, . . . . .	120 tons.

Work was started Nov. 17, 1906, by a dredge.

Very little work was done during the period covered by this report, and no payments were made.

of the Eye and Ear Infirmary on October 12, and has continued since that time with a small force. Pile-driving was started on the same day. The work of placing concrete was started on November 5.

A dredge began work on October 27.

The total value of the work done, as shown by the November, 1906, estimate, was \$15,818.57.

Earth excavation and refill, . . . . .	60 lin. ft.
Earth filling, . . . . .	30,243 cu. yds.
Piles in place, . . . . .	26,645 lin. ft.
Drains, . . . . .	65 lin. ft.
Concrete masonry, . . . . .	26 cu. yds.

*Contract No. 45, Richard F. Keough. — Furnishing Small Boat Lock-gates, Cambridge.*

On Sept. 10, 1906, bids were opened for the four lock-gates for the small boat lock at the sluices, and on Sept. 17, 1906, a contract was made with Richard F. Keough for constructing these gates for the sum of \$850.

A small amount of work under this contract was done, but no payments were made.

*Contract No. 46, New England Structural Company. — Furnishing Structural Steel, Boston.*

On Sept. 17, 1906, bids were received for the structural material, consisting of steel beams for the Lock stop-planks, together with girders and trusses for supporting the same in the Lock, and other structural material required principally at the Lock. On Sept. 19, 1906, a contract for this material was placed with the New England Structural Company for \$7,380.

Very little material had been delivered under this contract at the end of the period covered by this report, and no payments had been made.

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## APPENDIX.

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## APPENDIX A.

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CHAPTER 465 OF THE ACTS OF 1903, AS AMENDED BY CHAPTER 65  
OF THE ACTS OF 1905, AND BY CHAPTERS 368 AND 402 OF THE  
ACTS OF 1906.

AN ACT TO AUTHORIZE THE CONSTRUCTION OF A DAM  
ACROSS THE CHARLES RIVER BETWEEN THE CITIES  
OF BOSTON AND CAMBRIDGE.

*Be it enacted, etc., as follows:*

SECTION 1. The governor of the Commonwealth, with the advice and consent of the council, shall appoint three commissioners, residents of the metropolitan parks district, who shall constitute the Charles river basin commission, hereinafter called the commission, and who shall be sworn before entering upon the duties of their office. One commissioner shall be designated by the governor as chairman, and two commissioners shall constitute a quorum. The term of office shall be three years, and all vacancies shall be filled by the governor, with the advice and consent of the council. Any commissioner may be removed by the governor, with the advice and consent of the council, for such cause as he shall deem sufficient and shall assign in the order of removal. Each commissioner shall receive an annual salary of such amount as the governor and council shall determine.

Charles river  
basin commis-  
sion, appoint-  
ment, term,  
etc.

Compensation.

SECTION 2. The commission may appoint a secretary, engineers and assistants, shall keep accurate accounts of its expenditures, and shall make an annual report of its doings, including an abstract of its accounts, to the governor and council. The commission whenever the Commonwealth has been authorized by the United States to build a dam and lock under the provisions of this act, shall proceed to do the work herein required of it, and shall in the meantime make examinations and plans therefor.

Powers and  
duties.



The commission shall do all such dredging and all strengthening of the walls of the canals and of the basin where dredging is done by the driving of prime oak piles two feet on centres along the front of said wharves or walls, and all removing and relocating of pipes and conduits made necessary by such dredging, so that vessels requiring a depth of water not exceeding the respective depths above prescribed can lie alongside of, and in contact with, the wharves; and this work shall be done in such manner as to cause the least possible inconvenience to abutters, and shall be finished on or before the completion of the dam; and after the walls or wharves have been so strengthened, all repairs on or rebuilding of the walls and wharves shall be done by the abutters.

Manner of dredging, etc.

The commission shall do such dredging in the basin outside of the channels aforesaid as may be necessary for the removal of sewage, sludge or any offensive deposit; shall do such other dredging as it shall deem proper, and shall take all proper measures for the destruction of malarial mosquitoes in the basin and its vicinity.

Certain other dredging to be done, etc.

SECTION 5. The commission, before the completion of the dam, shall construct marginal conduits on the north side of the basin from the outlet of the overflow channel in Binney street to a point below the dam, and on the south side of the basin from the present outlet of the Back Bay Fens to a point below the dam, and may construct an extension thereof toward, or to, St. Mary street, the conduits to be used to receive and conduct below the dam the overflow from sewers and the surface drainage and other refuse matter which would otherwise pass into the basin.

Marginal conduits to be constructed, etc.

SECTION 6. The commission, for the purpose of carrying out the provisions of the preceding sections, may from time to time take in fee or otherwise, by purchase or otherwise, for the Commonwealth, or the city of Boston or the city of Cambridge, as the commission shall determine, lands, flats and lands covered by tide-water on Charles river, by filing in the registry of deeds for

Certain lands, etc., may be taken, etc.

the county and district in which the lands or flats are situated a description thereof, sufficiently accurate for identification, signed by a majority of the commissioners; and any person whose property is so taken may have compensation therefor as determined by agreement with the commission, and if they cannot agree the compensation may be determined by a jury in the superior court for the county where the property is situated under the same provisions of law, so far as they are applicable, which apply in determining the value of lands taken for highways under chapter forty-eight of the Revised Laws, upon petition therefor by the commission, or by such person, filed in the clerk's office of said court against the Commonwealth or the city for which the lands or flats are taken within one year after the taking, and costs shall be taxed and execution issued as in civil cases.

The metropolitan park commission to have exclusive control of dam, etc.

SECTION 7. The metropolitan park commission, when the work provided for in the preceding sections is finished, shall, subject to the powers vested by law in the state board of health, have exclusive care and control of the dam and lock and of any highway, park or parkway, drawbridge or drawbridges, constructed in connection therewith, and of the basin and river between the dam and the city of Waltham, as a part of the metropolitan parks system, and of all poles, wires and other structures placed or to be placed on, across, over or in any part of said basin, dam or lock, highway, park or parkway, drawbridge or drawbridges, and of the placing thereof, except the bridges and other structures erected by any city or town within its limits and upon its own lands; may make reasonable rules and regulations, not impairing freight traffic, for the care, maintenance, protection and policing of said basin, dam, lock, highway, park, parkway, drawbridge or drawbridges, breaches of which rules shall be breaches of the peace, punishable as such, and throughout the year shall operate the lock and drawbridge or drawbridges without charge, maintain the lock, channels and canals aforesaid at the depths aforesaid, and clear of obstructions caused by

May make rules and regulations, etc.



natural shoaling or incident to the building of the dam, and maintain the water in the basin at such level and the lock, channels and canals sufficiently clear of obstructions by ice so that any vessel ready to pass through the lock, and requiring no more depth of water than aforesaid, can pass through to the wharves aforesaid. In the event of an emergency, requiring the temporary reduction of such level, notice thereof shall be given to the occupants of said wharves, and such reduction shall not be lower nor continue longer than the emergency requires. Said metropolitan park commission may order the removal of all direct sewage or factory waste as a common nuisance from the river and its tributaries below the city of Waltham; and no sewer, drain, overflow or other outlet for factory or house drainage shall hereafter be connected with the basin below said city without the approval of the metropolitan park commission. *Said metropolitan park commission shall also have and exercise over said basin, dam, lock, highway, park, parkway, drawbridge or drawbridges, all other power, duties and liabilities now imposed upon said commission by chapter four hundred and seven of the acts of the year eighteen hundred and ninety-three, and acts in addition thereto, and in amendment thereof relative to the care, maintenance and control by said commission of open spaces for exercise and recreation so far as the provisions of said acts are consistent with the provisions of this act.*

Notice to be given in case of emergency requiring temporary reduction of level, etc.

Removal of direct sewage or factory waste may be ordered, etc.

SECTION 8. The Commonwealth shall in the first instance pay all expenses incurred in carrying out the provisions of sections *one, two, three, four, five, six, seven, eleven and twelve, as amended*, and the same shall, except as provided in the following section, constitute part of the cost of construction and maintenance of the metropolitan parks system; and in addition to the amounts heretofore authorized for such construction the treasurer and receiver-general shall, from time to time, as authorized by the governor and council, issue notes, bonds or scrip, in the name and behalf of the Commonwealth, entitled Charles River Basin Loan, to the amount which the commission may deem necessary for the ex-

Payment of expenses.

Charles River Basin Loan.



penses incurred under *sections one, two, three, four, five, six, eleven and twelve* of this act; and all acts and parts of acts relative to loans for such construction and providing for their payment shall, so far as they may be applicable and not inconsistent herewith, apply to such notes, bonds and scrip, and to their payment.

Apportion-  
ment of  
expenses, etc.

SECTION 9. The commissioners appointed under the provisions of chapter four hundred and nineteen of the acts of the year eighteen hundred and ninety-nine, and amendments thereof, in apportioning the expenses of maintaining the metropolitan parks system shall include as part thereof the expense of maintenance incurred under *sections one, two, three, four, five, six, seven, eight, eleven and twelve* of this act; shall also determine, as they shall deem just and equitable, what portion of the total amount expended for construction under sections three, four, five and six of this act shall be apportioned to the cities of Boston and Cambridge as the cost of the removal of Craigie bridge and the construction of a suitable bridge in place thereof, and the remainder shall be considered and treated as part of the cost of construction of the metropolitan park system; and shall

*also determine, as they shall deem just and equitable, what portion of the total amount expended for the cost of construction of the marginal conduit on the south side of the basin and of the embankment and park, provided for by this act, shall be apportioned to the city of Boston as the cost of the construction of said embankment and park, and what portion shall be fixed as the cost of said marginal conduit. The cost of the construction of said embankment and park, so apportioned, shall be repaid to the Commonwealth by the city of Boston with four per cent. interest from the date of said apportionment, and bills for the betterments assessed by the Charles river basin commission under the provisions of this act shall be listed and committed to the collector of taxes of the city of Boston, and shall be collected under the same provisions of law as betterments levied for the construction of highways in the city of Boston. All amounts so received by the*

*city of Boston from said betterments shall be applied first toward paying to the Commonwealth said apportionment for the cost of construction of said embankment and park as above provided; and second to the interest and sinking fund requirements of the loan of the city of Boston authorized by this act. The treasurer and receiver-general shall determine the payments to be made each year by the cities of Boston and Cambridge, one-half by each, to meet the interest and sinking fund requirements for the amounts apportioned to them as the cost of such bridge, and the same shall be paid by each city into the treasury of the Commonwealth as part of its state taxes. The city treasurer of Boston shall from time to time on the request of the mayor issue and sell bonds of the city to meet the payments to the Commonwealth required by this section, and the bonds so issued shall not be reckoned in determining the statutory limit of indebtedness of the city.*

SECTION 10. The city of Boston, by such officer or officers as the mayor may designate, shall forthwith after the passage of this act, do such dredging in the Back Bay Fens as the board of health of said city may require, shall construct a conduit between Huntington avenue and Charles river, to form an outlet into Charles river for the commissioners' channel of Stony brook, shall reconstruct the present connections between the river and the Fens so as to allow free access of water from the river into the streams and ponds in the Fens and thence into the river, and shall construct a sewer in the rear of the houses on the north side of Beacon street between Otter and Hereford streets. Such officer or officers may construct a conduit between Green street and Forest Hills and may construct or rebuild within five years one or more conduits for Stony brook between the westerly side of Elmwood street and the Fens: *provided, however,* that the expense of such conduits between Green street and Forest Hills and between Elmwood street and the Fens shall be paid for out of the annual appropriation for sewer construction under the provisions of chapter four hundred and twenty-six of the

City of Boston  
to do certain  
dredging,  
construct con-  
duits, sewer,  
etc.

Proviso.

acts of the year eighteen hundred and ninety-seven and acts in amendment thereof or in addition thereto.

Wall or embankment may be built on Boston side of Charles river.

SECTION 11. *The Charles river basin commission shall build a wall and embankment on the Boston side of Charles river beginning at a point in the southwest corner of the stone wall of the Charlesbank, thence running southerly by a straight or curved line to a point in Charles river not more than three hundred feet westerly from the harbor commissioners' line, measuring on a line perpendicular to the said commissioners' line at its intersection with the southerly line of Mount Vernon street, but in no place more than three hundred feet westerly from the said commissioners' line; thence continuing southerly and westerly by a curved line to a point one hundred feet or less from the wall in the rear of Beacon street; thence by a line substantially parallel with said wall, but at no point more than one hundred feet distant therefrom to the westerly line of the Back Bay Fens, extended to intersect said parallel line.*

Certain lands, flats, etc., may be taken for a public park.

SECTION 12. *The Charles river basin commission shall acquire in fee, or otherwise, by purchase or otherwise, for the city of Boston, for the purpose of a public park, parkway or street, flats and lands covered by tide water and lying easterly of Charlesgate West by filing in the registry of deeds for the county of Suffolk a description thereof sufficiently accurate for identification, signed by a majority of said commission, and shall construct a public park or lay out a parkway or street, on the lands so taken: provided, however, that nothing herein contained shall authorize the taking for any purpose of Back street, or of any lot or part of any lot on the north side of Beacon street or of any flats or lands covered by tide water south of West Boston bridge and lying between the line of the wall the construction whereof is provided for in section eleven of this act and the Cambridge shore, nor the taking for any purpose but that of a public park of any flats or land covered by tide water between said wall and the sea wall as at present existing; and any person whose property*

Provided.



is so taken may have compensation therefor as determined by agreement with the commission, or, in the absence of such agreement, the amount thereof may be determined by a jury in the superior court for the county of Suffolk upon petition therefor by the commissioners or by such person, filed in the clerk's office of said court, against the Commonwealth, and within one year after the taking, and under the same proceedings and provisions of law, so far as they may be applicable, which apply in determining the value of lands taken for highways under chapter forty-eight of the Revised Laws. And because of the construction and maintenance of the embankment and park as herein provided, and the establishment of the northerly line thereof as herein finally fixed and defined as the limit of any embankment or construction northerly from Beacon street between the Charlesbank and the Back Bay Fens, said commission shall within two years after the completion of the park as herein provided and defined determine the value of the benefit or advantage, from the establishment of said embankment and park, beyond that resulting to all real estate in the city of Boston, to each parcel of real estate east of the Back Bay Fens bordering upon or near said embankment and park as so completed, and shall assess such betterment upon the said estates so benefited; but such assessments shall in no event exceed in the aggregate one-half of the actual cost of construction of said embankment and park, exclusive of the cost of the marginal conduit, nor the sum of thirty dollars for each lineal front foot of private ownership. Any person aggrieved by such assessment of betterments may within one year thereafter file a petition in the superior court for the county of Suffolk, and after notice to the city of Boston shall have a trial by jury therein, and costs shall be awarded as provided in section seven of chapter fifty of the Revised Laws.

SECTION 13. The city of Boston shall pay the expenses incurred under section ten of this act, except as otherwise provided in said section ten; and to meet said expenses the city treasurer of the city shall, from time

City of Boston  
to pay certain  
expenses, etc.

## CONTRACTS MADE AND PENDING,

1. No. of Contract.	2. WORK.	3. No. of Bids.	AMOUNT OF BID.		6. Contractor.
			4. Next to Lowest.	5. Lowest.	
1	22 <sup>1</sup>	Borings at Lock and sluices.	- <sup>2</sup>	- <sup>2</sup>	Gow & Palmer, Boston, Mass.
2	23	Piles along walls of canals and Basin.	- <sup>2</sup>	\$25,117 26 <sup>2</sup>	Holbrook, Cabot & Rollins Corporation.
3	24	Scherzer rolling lift bridge.	\$41,562 00	40,800 00 <sup>2</sup>	American Bridge Company of New York, New York, N. Y.
4	25	Sluice-gates at the sluices in the Dam.	27,993 00	24,800 00 <sup>2</sup>	Coffin Valve Company.
5	26 <sup>1</sup>	22-foot whale-boat launch.	- <sup>2</sup>	525 00 <sup>2</sup>	E. Gerry Emmons Corporation, Boston, Mass.
6	27	Sluice-gates on the lock-gates in the Lock.	- <sup>2</sup>	17,093 00 <sup>2</sup>	Coffin Valve Company.
7	28	Tide-gates at the Dam and Lock.	4,907 00	4,438 00 <sup>2</sup>	Coffin Valve Company.
8	29 <sup>1</sup>	Twisted steel rods for reinforcing concrete.	3,429 08	3,371 03 <sup>2</sup>	Aberthaw Construction Company.
9	30	Lock-gates.	30,975 00	26,784 00 <sup>2</sup>	New Jersey-West Virginia Bridge Company, New York, N. Y.
10	31 <sup>1</sup>	Axis for Lock-gate trucks.	- <sup>2</sup>	1,930 00 <sup>2</sup>	The William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa.
11	32	Spruce lumber for repairing temporary bridge.	2,600 00	2,440 00 <sup>2</sup>	George W. Gale Lumber Company, Cambridge, Mass.
12	33	Castings and other metal.	3,285 63	2,025 10 <sup>2</sup>	Chelmsford Foundry Company, Boston, Mass.
13	34	White oak lumber for Lock.	-	646 43 <sup>2</sup>	George McQuesten Company.
14	35	Castings and other metal.	-	3,322 00 <sup>2</sup>	Gibby Foundry Company.

<sup>1</sup> Contract completed.<sup>2</sup> Competitive bids were not received on this contract.



# APPENDIX B.

77

OCT. 1, 1905, TO NOV. 30, 1906 — *Continued.*

7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Nov. 30, 1906.	
Nov. 6, '05,	-	Jan. 8, '06,	For borings, \$0.65 per. lin. ft.	\$1,681 03	\$1,681 03	1
Dec. 4, '05,	-	-	For oak piles driven, \$14 per pile; oak piles over 42 feet in length an additional price of \$0.40 per lin. ft. for each foot of excess; long leaf yellow pine lumber in place, \$57 per M. ft. B. M.; iron or steel in place, \$0.03 per lb.	72,360 00	43,587 98	2
Mar. 16, '06,	-	-	For the whole work, \$40,800.	40,800 00	2,026 19	3
Mar. 16, '06,	-	-	For the whole work, \$24,800.	24,800 00	-	4
Feb. 27, '06,	Mar. 9, '06,	Mar. 20, '06,	For the whole work, \$525.	525 00	525 00	5
Mar. 6, '06,	-	-	For the whole work, \$17,093.	17,093 00	-	6
Mar. 16, '06,	-	-	For the whole work, \$4,438.	4,438 00	2,602 80	7
Mar. 10, '06,	May 11, '06,	May 18, '06,	For square twisted steel rods, \$1.90 and \$2.10 per hundred lbs.	3,461 66	3,461 66	8
June 13, '06,	-	-	For the whole work, \$26,784.	26,784 00	-	9
Apr. 3, '06,	May 3, '06,	June 18, '06,	For forged Parsons' manganese bronze axles, \$0.295 per lb.	1,929 60	1,929 60	10
Apr. 4, '06,	Jan. 1, '07,	-	For 2-inch spruce plank, \$24.40 per M. ft. B. M.	3,600 00	3,479 10	11
May 23, '06,	July 22, '06,	-	For iron castings, \$0.0215 and \$0.02 per lb; checkered steel plate, \$0.06 per lb.	2,025 10	606 47	12
Apr. 11, '06,	July 10, '06,	-	For white oak lumber, \$65 per M. ft. B. M.	646 43	54 15	13
May 29, '06,	July 28, '06,	-	For bollards, \$51.50 each; material for sheaves, \$570; other iron castings, \$0.0365 per lb.	3,322 00	2,247 07	14

<sup>2</sup> Contract based upon this bid.

<sup>4</sup> Bids were based on different plans and specifications.

## CONTRACTS MADE AND PENDING,

1. No. of Contract.	2. WORK.	3. No. of Bids.	AMOUNT OF BID.		6. Contractor.
			4. Next to Lowest.	5. Lowest.	
1 36 <sup>1</sup>	Twisted steel rods for reinforcing concrete.	3	\$707 31	\$694 16 <sup>2</sup>	Fred A. Hoodlette & Son, Boston, Mass.
2 37	Electric dock capstans at Lock.	2 <sup>3</sup>	2,100 00 <sup>2</sup>	1,576 00	American Ship Windlass Company, Providence, R. I.
3 38	Motors for operating Lock-gates.	2	2,700 00	2,635 40 <sup>2</sup>	Westinghouse Electric & Manufacturing Company, Boston, Mass.
4 39 <sup>1</sup>	Crane rail for Lock-gates.	— <sup>4</sup>	— <sup>4</sup>	935 00 <sup>3</sup>	H. W. Hayes & Co., Boston, Mass.
5 40	Plug drain valves.	2	1,096 00	867 71 <sup>3</sup>	Chapman Valve Manufacturing Company, Indian Orchard, Mass.
6 41	Sluice-gates at the sluices and Boston Marginal Conduit.	— <sup>4</sup>	— <sup>4</sup>	11,862 00 <sup>2</sup>	Coffin Valve Company.
7 42 <sup>1</sup>	Steel beams, rods and plates.	9	4,668 00	4,557 00 <sup>3</sup>	New England Structural Company, Boston, Mass.
8 43	Manganese bronze studs and bolts.	— <sup>4</sup>	— <sup>4</sup>	770 09 <sup>3</sup>	The William Cramp & Sons Ship & Engine Building Company.
9 44	Section 3 of the Boston Marginal Conduit and Section 1 of the Boston Embankment.	7	241,845 00	232,700 00 <sup>3</sup>	Coleman Brothers, Charlestown, Mass.
10 45	Small boat lock-gates.	4	1,337 50	850 00 <sup>3</sup>	Richard F. Keough, East Boston, Mass.
11 46	Structural steel.	3	7,380 00 <sup>1</sup>	7,200 00 <sup>3</sup>	New England Structural Company.

<sup>1</sup> Contract completed.<sup>2</sup> Contract based upon this bid.<sup>3</sup> Bids were upon different types of capstans.

## APPENDIX B.

79

OCT. 1, 1905, to Nov. 30, 1906 — *Continued.*

7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Nov. 30, 1906.	
May 23, '06,	June 15, '06.	Aug. 31, '06,	For square twisted steel rods, \$1.925 per hundred lbs.	\$682 81	\$682 81	1
May 24, '06,	-	-	For the whole work, \$2,100.	2,100 00	-	2
May 25, '06,	-	-	For the whole work, \$2,635.40.	2,635 40	-	3
May 26, '06,	Aug. 1, '06,	Sept. 1, '06,	For the rail, including splice bars, bolts and nuts, \$0.0425 per lb.	944 20	944 20	4
June 7, '06,	Aug. 6, '06,	-	For 8-inch valves, \$57.53 each; 6-inch valves \$31.95 and \$35.49 each.	867 71	-	5
June 14, '06,	-	-	For the whole work, \$11,862.	11,862 00	-	6
July 5, '06,	Sept. 3, '06,	Nov. 17, '06,	For the whole work, \$4,557.	4,557 00	4,557 00	7
June 15, '06,	July 15, '06,	-	For stud bolts, \$0.49 per lb.; lag screws, \$0.3325 per lb.	770 09	-	8
Sept. 24, '06,	Jan. 1, '08,	-	For earth excavation and refill, \$20 per lin. ft. of trench; earth filling, \$0.27 and \$0.50 per cu. yd.; piles, \$0.14 and \$0.20 per lin. ft.; drains, \$0.60 per lin. ft.; concrete masonry, \$8 and \$7 per cu. yd.; ashlar masonry, \$16 and \$30 per cu. yd.; face dressing of pointed work, \$0.40 per sq. ft.; sheeting, \$30 per M. ft. B. M.; yellow pine lumber, \$50 per M. feet B. M.; wrought iron and steel, \$0.07 per lb.; placing iron and other metal work, \$40 per ton of 2,000 lbs.	232,700 00	13,445 78	9
Sept. 17, '06,	-	-	For the whole work, \$850.	850 00	-	10
Sept. 19, '06,	Dec. 18, '06,	-	For the whole work, \$7,380.	7,380 00	-	11

\*Competitive bids were not received on this contract.

\* Bid\*did not comply with requirements for delivery.

## CONTRACTS MADE AND PENDING,

1. No. of Contract.	2.  WORK.	3. No. of Bids.	AMOUNT OF BID.		6.  Contractor.
			4. Next to Lowest.	5. Lowest.	
1 47	Yellow pine timber for Lock stop-planks.	2	\$763 30	\$742 00 <sup>1</sup>	George McQuesten Com- pany.
2 48	Steam, water and air piping.	9	2,158 00	2,098 00 <sup>1</sup>	The Lunsden & Van Stone Company.
3 49	Small boat lock-gate hinges.	- <sup>2</sup>	- <sup>2</sup>	1,260 00 <sup>1</sup>	The William Cramp & Sons Ship & Engine Building Company.
4 50	Section 4 of the Boston Marginal Conduit and Section 2 of the Bos- ton Embankment.	5	200,860 00	198,890 00 <sup>1</sup>	Holbrook, Cabot & Hol- lins Corporation.
5 52	Twisted steel rods for reinforcing concrete.	4	1,726 07	1,706 23 <sup>1</sup>	Aberthaw Construction Company.
	Totals,				

<sup>1</sup> Contract based upon this bid.<sup>2</sup> Competitive bids were not received on this contract.

# APPENDIX B.

81

Oct. 1, 1905, to Nov. 30, 1906 — *Concluded.*

7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Nov. 30, 1906.	
Sept. 13, '06,	Nov. 12, '06,	-	For yellow pine timber, \$35 per M. ft. B. M.	\$742 00	-	1
Oct. 20, '06,	-	-	For the whole work, \$2,098.	2,098 00	-	2
Sept. 24, '06,	Nov. 1, '06,	-	For the whole work, \$1,260.	1,260 00	-	3
Nov. 5, '06,	Jan. 1, '08,	-	For earth filling, \$0.40, \$0.53 and \$0.68 per cu. yd.; piles \$0.17 and \$0.20 per lin. ft.; drains, \$0.60 per lin. ft.; concrete masonry \$12 and \$8 per cu. yd.; ashlar masonry, \$18.50 and \$25 per cu. yd.; face dressing of pointed work, \$0.60 per sq. ft.; yellow pine lumber, \$60 per M. ft. B. M.; wrought iron and steel, \$0.05 per lb.; placing iron and other metal work, \$25 per ton of 2,000 lbs.	198,890 00	-	4
Oct. 17, '06,	Feb. 1, '07,	-	For square twisted steel rods, \$1.95 and \$2.15 per hundred lbs.	1,706 23	225 31	5
				\$1,642,227 93	\$584,952 67	

<sup>2</sup> Two lower bids, for \$2,030 and \$2,068 respectively, were informal, — not in accordance with the requirements of "Information for bidders."



1

1

## APPENDIX B.

79

**OCT. 1, 1905, to Nov. 30, 1906** - *Continued.*

7. Date of Contract.	8. Date for Completion of Contract	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Nov. 30, 1906.
May 23, '06.	June 15, '06	Aug. 31, '06.	For square twisted steel rails, \$1.925 per hundred lb.	\$682.81	\$682.81
May 24, '06.			For the whole work, \$2,100.	2 100.00	-
May 25, '06.			For the whole work, \$2,635.40.	2,635.40	-
May 26, '06.	Aug. 1, '06.	Sept. 1, '06.	For the rail, including splice bars, bolts and nuts, \$0.0125 per lb.	.944.20	.944.20
June 7, '06.	Aug. 6, '06.		For 8 inch valves, \$57.53 each; 6 inch valves \$31.95 and \$35.49 each	867.71	-
June 14, '06.			For the whole work \$11,862	11 862.00	-
July 5, '06.	Sept. 3, '06.	Nov. 17, '06.	For the whole work \$4,557	4 557.00	4 557.00
July 15, '06.	July 15, '06.		For stud bolts, \$0.40 per lb.; lag screws \$0.3125 per lb.	770.00	-
Sept. 24, '06.	Jan. 1, '06.		For earth excav- tion and retail, \$20 per cu. yd.; trench, earth, 5 ft. deep, \$0.27; and \$0.50 per cu. yd.; pipes, \$0.14; and \$0.20 per ft.; rivets, \$0.04; plates, per sq. ft., \$0.02; bolts, \$0.03; and nuts, \$0.01; steel, \$0.10; and other items, \$0.01; for the whole work, \$200.00	212 700.00	11 145.78
Sept. 17, '06.			For the whole work \$87.00	87.00	-
Sept. 19, '06.	Dec. 19, '06.		For the whole work \$7,480.00	7 480.00	-

\*Competitive bids were not received on this contract

<sup>b</sup> Did not comply with requirements for delivery



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DRAWBRIDGE OVER LOCK—LOOKING TOWARD CAMBRIDGE BRIDGE.



FIFTH ANNUAL REPORT  
OF THE  
CHARLES RIVER BASIN  
COMMISSION.

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1906-DECEMBER 1, 1907.



BOSTON:  
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,  
18 POST OFFICE SQUARE.  
1908.



**APPROVED BY  
THE STATE BOARD OF PUBLICATION.**

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# Commonwealth of Massachusetts.

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## FIFTH REPORT OF THE CHARLES RIVER BASIN COMMISSION.

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*To His Excellency the Governor and the Honorable Council of the Commonwealth of Massachusetts.*

The Commission appointed under chapter 465 of the Acts of 1903, known as the Charles River Basin Commission, has the honor to make the following report of its proceedings for the fiscal year ending Nov. 30, 1907. As required by law, the Commission filed, on Jan. 14, 1908, with the Secretary of the Commonwealth a statement of its expenditures and receipts, which is printed herewith. The Commission also filed an abstract of its doings for the fiscal year.

### I. ORGANIZATION AND ADMINISTRATION.

#### (a) *The Commission, Officers and Employees.*

The membership of the Commission remained the same as in the preceding year: Henry S. Pritchett, Chairman, Henry D. Yerxa and Joshua B. Holden. William S. Youngman continued as Secretary, and Hiram A. Miller as Chief Engineer.

No change was made in the administrative office force. Twenty-nine engineers and inspectors were engaged during the year, some for summer work and some to take the place of men who had resigned. At the end of the year there were nine additional engineers and inspectors in the employ of the Commission. Other changes and promotions in the engineering force are described in the report of the Chief Engineer, appended.



*(b) Offices and Buildings.*

The office of the Charles River Basin Commission is located on the sixth floor of the Standish Building, No. 367 Boylston Street. The principal field office is at No. 12 Bridge Street, East Cambridge. For its work on the Boston Embankment the Commission maintained a smaller field office at No. 108 Chestnut Street. The center of much of the Commission's mechanical work is in the steel shed at the corner of Charles and Leverett streets, Boston.

**II. THE DAM AND LOCK.**

*(a) The Lock and Lock-gates in the Boston Cofferdam.*

The masonry for the Lock was completed during the year, although work within the Boston coffer-dam was practically at a standstill throughout the winter, owing to the extremely cold weather which began early and continued well into March. Some of the men employed by the Commission were occupied in assembling the stop-planks for the ends of the Lock and placing them in position. At the same time the tracks for the lock-gates were laid. The material for the lock-gates, which was fabricated in Wheeling, W. Va., was not received here until autumn, but by the end of the year the gate in the down-stream recess was very nearly assembled and a good start had been made on the gate in the up-stream recess. The thirteen sluice-gates to be used on the lock-gates for filling and emptying the Lock were delivered at the site of the work, and the work of erection was begun before the end of the year.

The Scherzer rolling lift double drawbridge over the lower end of the Lock is substantially completed. A temporary operating tower for the controllers for the lock-gates and the drawbridge was built at the south side of the roadway near the drawbridge.

*(b) Passage of Vessels through the Lock will be Accelerated.*

Two electrically operated capstans have been furnished and installed on the easterly side wall of the Lock by the American Ship Windlass Company, of Providence, R. I. By means of



LOCK - South End.





SLUICES—UP-STREAM FACE.

ALL EILENX AND  
FOUNDA FOUNDATIONS



these capstans the progress of vessels through the Lock will be expedited, so that the delay to street traffic caused by opening the drawbridge will be made as slight as possible.

(c) *The Sluices in the Cambridge Cofferdam.*

Owing to the severity of the weather, work on the sluices in the Cambridge coffer-dam was suspended from Dec. 15, 1906, to April 11, 1907, when work was resumed and pushed as rapidly as possible. The masonry work of the sluices was practically completed about the first of August. All the sluice-gates which were to be installed at this point have been erected, together with most of their operating machinery. A test was made of one of the gates and it was found satisfactory. The switchboards and controllers, however, have not yet been put in place.

(d) *The Shut-off Dam.*

The temporary dam which the Commission will construct between the Boston and Cambridge coffer-dams and will connect with the Cambridge shore is called the shut-off dam. As the work upon the sluices and the Lock approaches completion, it becomes possible for the Commission to take up the problem of closing the river without interfering with navigation or with the convenience of the people living on the banks of the Basin.

**The shut-off dam will not only accomplish the purpose of greatly facilitating the work of building the permanent Dam, but it will have the effect of giving to the public the use of the Basin for a considerable period before the completion of the permanent Dam and the roadway and park area which are to be parts of the structure.**

It is obvious that it would be impossible to construct a dam consisting chiefly of earthwork, with the tide ebbing and flowing twice daily. As the space between the two ends of the dam narrowed, the velocity of the currents would constantly increase, the earth filling would be scattered by the tides, and it would finally become impossible to keep the work in position. To avoid this difficulty the Commission has begun the construction of its shut-off dam, which will be primarily a pile structure. Pile bents will be driven about 8 feet apart across the river between the two coffer-dams, and timber sluice-gates will be

hung between them in such a way that when the time comes for making the final shut off they may be quickly lowered into place to make a continuous timber wall across the river. This will, of course, stop all tidal flow, and it will be possible to put in the earth filling and make it stay in place. Vessels will then be locked through, and the sluices will be used to regulate the height of the Basin in practically the same way that they will be used in the permanent Dam.

### **III. THE BOSTON EMBANKMENT.**

The Commission has made no changes in its plans for the Boston Embankment from those described in its fourth report. It has participated in the deliberations of the Metropolitan Park Commission, constituting with that Board the joint board created by chapter 404 of the Acts of 1907 for the purpose of granting locations for boat-houses on the embankment, in the rear of Charles and Brimmer streets.

Work on the embankment continued steadily throughout the year and considerable progress was made. The pile-driving and the filling with earth continued during the winter whenever the weather permitted, and the masonry work was resumed as early in the spring as possible. Nearly all the piles required for that part of the Basin wall to be built by the contractor for Section 1, which extends from the new Cambridge Bridge to a point near Berkeley Street, have been driven; and the masonry of the wall itself is completed from the bridge to Mt. Vernon Street, with the exception of the coping which, under the terms of the contract, is not to be put in place until after the embankment which is behind the wall is completed. A considerable amount of filling has also been put in on sections 2 and 3 of the Boston Embankment, extending from Berkeley Street nearly to Charlesgate East.

### **IV. DELAY AND CHANGES IN THE COMMISSION'S WORK DUE TO THE RIVERBANK SUBWAY ACT OF 1907.**

Owing to enforced delays which are authorized by law, it will be impossible for the Commission to complete the Boston Embankment by the time the Basin is established. Section 2



BOSTON EMBANKMENT—CONTRACTOR'S PLANT.

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of chapter 573 of the Acts of 1907, which provides for the construction by the Boston Transit Commission of the Riverbank subway within the Boston Embankment which this Commission is now building, directs that:—

The Charles River Basin Commission shall make such changes in its plans for constructing the embankment and park aforesaid, and the conduit, drains or other structures therein or appurtenant thereto, and in the construction thereof, as the transit commission may determine to be required in connection with the proper location and construction of the subway herein provided for, and shall postpone or omit any part of the work provided for . . . which it may be necessary or expedient to postpone or which may be rendered unnecessary by or in view of the work herein provided for.

Under authority of this section the Boston Transit Commission has made several requests for changes in the Commission's plans and work, all of which have been complied with.

#### V. THE CRAIGIE TEMPORARY BRIDGE.

The temporary bridge has been maintained during the year without any serious delay to traffic. One or two small fires occurred on the bridge during the summer, but they were extinguished before any appreciable damage was done.

#### VI. THE MARGINAL CONDUITS.

##### (a) *The Boston Marginal Conduit.*

Work on the conduit progressed at a reasonable rate and at the end of the year it had been completed from the end of Section 2, near the Cambridge Bridge, to a point near Mt. Vernon Street, and piles had been driven for a large part of the conduit remaining to be built. Seven-tenths of a mile of this conduit have been completed and 1.1 miles are now in process of construction. Besides intercepting the various sewer overflows from the cross streets along its course, the conduit will connect with the Stony Brook channels at Charlesgate East and may also be used to provide circulation for the Fens Ponds.



(b) *The Cambridge Marginal Conduit.*

The contract for the Cambridge Marginal Conduit was awarded about the middle of August and work was commenced on the 30th. The stop-plank chambers near Lechmere Canal were practically completed at the end of the year. The work of building the inverted siphon for the Cambridge Marginal Conduit at Lechmere Canal was made a separate contract, which was executed on September 12. A portion of the work had been done at the end of the year.

(c) *The Sewer Overflow Connections with the Boston Marginal Conduit.*

As fast as the completed portion of the conduit has reached the streets at which the sewer overflows discharge into the river, the concrete connections from these overflows have been built to the conduit and temporary wooden outlets have been built extending from the conduit to points a little outside of the proposed Basin wall. At the end of the year the sewer overflow connections at Pinckney and Mt. Vernon streets had been completed and the temporary outlets at Dartmouth and Fairfield streets were nearly done, although the permanent connections with the outlets at the existing wall had not been built.

VII. DREDGING AND PILE-DRIVING AT THE WHARVES IN BROAD AND LECHMERE CANALS.

Piles have been driven and capped in front of nearly all the properties in both Broad and Lechmere canals, — a total distance of about 1.8 miles of piling, — and the dredging to be done in Broad Canal is practically completed between First and Sixth streets. A channel about 60 feet wide has been dredged from the Basin to and opposite the wharf of the Wellington-Wild Coal Company. About 8,000 cubic yards of material have been excavated.



BOSTON MARGINAL CONDUIT — NEAR LOCK.



### VIII. LEGISLATION OF 1907.

The Commission made no recommendation to the Legislature of 1907 for legislation.

The most important act passed affecting its powers is chapter 404 (which is printed in Appendix A of this report), relating to the granting of locations for boat-houses on the Boston Embankment.

Besides chapter 269, relative to the hours of labor, which will be referred to later, there was one other act of the Legislature of 1907 which has an important bearing on the Commission's work. This is chapter 573, from which a clause has been quoted on page 5, and which provides for the Riverbank subway to be built in the Boston Embankment now under construction by this Commission.

### IX. TAKINGS OF PROPERTY.

For the purposes of driving piles and dredging in Broad and Lechmere canals, as provided in section 4 of the Charles River Basin Act, the Commission made takings in Cambridge in front of the properties of Annie B. Matthews and Sarah M. Fay, heirs of Howard Coon, Walter J. Connery and Walter A. Wentworth, Sylvester Tower Company, and Mary A. Linehan.

For the purpose of connecting Section 2 of the Boston Marginal Conduit in the Charlesbank with Section 3 of the same conduit in the Boston Embankment, the Commission took an easement on the land of the Massachusetts Charitable Eye and Ear Infirmary on Charles Street in Boston.

### X. LITIGATION.

A settlement was made with E. Ricker, Son & Co., petitioners for damages on account of taking of leasehold rights and buildings on the Proctor property in East Cambridge.

The following new petitions for damages were filed during the year, chiefly on account of the taking dated Oct. 8, 1906, by the Commission of riparian rights if any should prove to be held by private individuals within the area of the Boston

**Embankment:** Isaac Cohen, George W. Parker, The Home for Aged Women, Henry L. Higginson *et al.*, trustees, Alfred Bowditch *et al.*, trustees, Francis Skinner, Robert Treat Paine, trustee, Maria M. McClure, Georgianna Hopkins, Harry S. Hall, George Wigglesworth *et al.*, Caroline S. Freeman, Laura L. Case, Mary L. Ware, Massachusetts Charitable Eye and Ear Infirmary (on account of two takings), Annie Fields, Elizabeth S. Beal, Carleton Hunneman, Thomas P. Beal *et al.*, trustees, Maria W. Sleeper, Helen A. Homans, Wallace L. Pierce, Edward W. Hutchins, George A. Goddard, Henry Parkman *et al.*, trustees, Robert C. Heaton *et al.*, John Parkinson, Jonathan H. Mann *et al.*, Fannie L. Prince, James R. Hooper, Sarah F. Niles *et al.*, Katherine B. Edmands, Katherine C. Pierce, Louise P. Inches, Georgianna O. Taylor, Rebecca W. Brown *et al.*, Mary C. Sears, Francis Shaw, Mary M. Taylor, Richard D. Sears, Charles E. Cotting *et al.*, trustees, Robert C. Hooper *et al.*, executors, Octave L. Apthorp, John D. Williams, trustee, Lillian C. Prince, Harriet L. Putnam, Frances E. Jackson, Henry F. Allan (2), Richard Sullivan, Ruth W. Sears, Schuyler S. Bartlett *et al.*, trustees, Ellen M. Abbott, Katharine M. Abbott, George B. Shattuck, Ralph B. Williams, Frederick C. Shattuck *et al.*, Helen G. Means, Heloise Meyer, Martha P. Stackpole, Esther H. Stanton, Christiana S. Whitney *et al.*, Arthur P. Tarbell *et al.*, trustees, Edward Jewell, Catherine A. Barstow, Helen C. Moseley, Mary H. Loring *et al.*, Julia Coolidge.

## XI. CONTRACTS.

### (a) *Labor.*

Since chapter 269 of the Acts of 1907 became effective, the Commission has put into all of its contracts the provision of law that no laborer, workman or mechanic working within the Commonwealth on any of the Commission's work shall be requested or required to work more than eight hours in any calendar day. The Commission has also complied with a further provision of the same act that no laborer, workman or mechanic directly in the employ of the Commonwealth shall be requested or required to work more than forty-eight hours



in any week. The effect of this statute will be to cause a considerable increase in the cost of the Commission's work.

(b) *List of Contracts.*

A list of the contracts awarded and pending during the year will be found in Appendix B. The contracts are discussed in the Chief Engineer's report, hereto annexed.

(c) *Sums held back from Contractors.*

The amounts reserved from sums due all contractors on monthly estimates, and not payable until after the completion of the contracts or until final settlement, are as follows:—

No. of Contract.	Name.	Work.	Amount.
1	Holbrook, Cabot & Rollins Corporation.	Dam and Lock in the Charles River.	\$40,000 00
23	Holbrook, Cabot & Rollins Corporation.	Piles along walls of canals and Basin.	6,215 22
24	American Bridge Company of New York.	Scherzer rolling lift bridge, . .	5,250 00
25	Coffin Valve Company, . . .	Sluice-gates at the sluices in the Dam.	5,300 00
27	Coffin Valve Company, . . .	Sluice-gates on the lock-gates in the Lock.	1,452 50
30	New Jersey-West Virginia Bridge Company.	Lock-gates, . . . . .	2,700 00
41	Coffin Valve Company, . . .	Sluice-gates at the sluices and Boston Marginal Conduit.	2,251 75
44	Coleman Brothers, . . . .	Section 3 of the Boston Marginal Conduit and Section 1 of the Boston Embankment.	29,616 85
50	Holbrook, Cabot & Rollins Corporation.	Sections 4 and 5 of the Boston Marginal Conduit and Sections 2 and 3 of the Boston Embankment.	12,364 60
59	The Lockwood Manufacturing Company.	Timber ice-run gate, . . . .	76 23
63	Baltimore Bridge Company, . .	Lock-gate operating chain supports.	771 45
69	Camden Iron Works, . . . .	Cast-iron pipes and special castings.	684 25
70	Patrick McGovern, . . . .	Main portion of the Cambridge Marginal Conduit.	401 63
76	Hiram W. Phillips, . . . .	Inverted siphon for the Cambridge Marginal Conduit, at Lechmere Canal.	130 50
			<hr/> \$107,214 98

## XII. HEARINGS, MEETINGS AND CONFERENCES.

The Commission gave during the year twenty-four hearings, at which a total of fifty-two persons were heard, besides holding sixty-two formal meetings and many conferences, as will more fully appear in its official minutes.

### XIII. ISSUE OF BONDS.

On Jan. 29, 1907, the Commission advised the Treasurer of the Commonwealth to make available additional funds to the amount of \$1,150,000 for the year 1907. Bonds to the amount above named were issued and sold under the title of the "Charles River Basin Loan." The total issue of bonds on account of the Charles River Basin Loan to Dec. 1, 1907, is \$2,400,000.

### XIV. PAYMENTS TO THE SINKING FUND.

Payments to the sinking fund of the Charles River Basin Loan during the year amounted to \$41,913.64. The total payments to the sinking fund to Dec. 1, 1907, were \$107,026.44.

### XV. REPORTS ISSUED BY THE COMMISSION.

Fifteen hundred reports were printed, at a cost of \$554.83. Of this number the Commission received for distribution only 450 copies to meet the demands of officials and citizens of the thirty-eight cities and towns which are to pay for the Charles River Basin work. Though the supply of reports for distribution by the Commission this year was larger than last, the demand, which has always exceeded the supply, was still further increased.

### XVI. STATEMENT OF EXPENDITURES AND RECEIPTS.

The following statement of expenditures and receipts was filed on Jan. 14, 1908:—

The total amount of expenditures from Dec. 1, 1906, to Nov. 30, 1907, is \$688,545.66. The total amount from July 29, 1903, the date when the Commission was organized, to Nov. 30, 1907, is \$1,635,183.89, and the total amount of receipts between the same dates is \$2,082.49.

The general character of these expenditures and receipts is shown in the following tables:—

*Expenditures.*

	For the Year Ending Nov. 30, 1907.	From Beginning of Work to Nov. 30, 1907.
<i>Administration.</i>		
Commissioners, . . . . .	\$10,000 00	\$43,024 69
Chief clerk, . . . . .	3,000 00	8,483 33
Chief stenographers, . . . . .	1,265 31	3,508 15
Services, . . . . .	10 00	18 00
Printing, . . . . .	478 15	771 88
Telegraph and printing, . . . . .	844 00	2,608 82
Freight, express and telegrams, . . . . .	92 31	193 85
Furniture and fixtures, . . . . .	35 00	479 01
Repairs and repairs of building, . . . . .	—	123 10
Telephone and lighting, . . . . .	297 86	542 65
Telephone, . . . . .	285 72	1,339 30
Various expenses, . . . . .	249 08	398 65
	\$16,557 43	\$61,491 43
<i>Engineering.</i>		
Principal assistant and division		
Engineers, . . . . .	\$14,090 38	\$47,420 73
Chief assistants, . . . . .	43,504 43	102,814 66
Chief engineers, . . . . .	4,262 70	10,801 10
Surveyors, . . . . .	26,950 75	46,888 70
Inspectors, . . . . .	1,890 16	2,984 88
Chief engineer, . . . . .	624 07	1,436 11
Chief clerk, . . . . .	19 25	79 75
Chief printer, . . . . .	1,260 79	4,064 06
Freight, express and telegrams, . . . . .	67 05	212 34
Tools, . . . . .	3,035 44	7,335 03
Engineering and drafting supplies, . . . . .	722 42	1,880 00
Maps and photographs, . . . . .	862 45	2,611 80
Furniture and fixtures, . . . . .	810 19	3,131 89
Repairs and repairs of building:—		
In office, . . . . .	16 00	1,108 14
In office, . . . . .	134 86	456 29
Telephone and lighting, main office, . . . . .	295 32	905 86
Telephone, lighting, heating, water and		
of building, sub offices, . . . . .	643 94	1,200 11
Main office, . . . . .	1,714 32	7,160 83
Field offices, . . . . .	180 00	431 45
Supplies, . . . . .	687 49	840 83
Various expenses, . . . . .	130 19	339 29
	101,902 20	244,113 93
<i>Construction — Preliminary.</i>		
Planning, . . . . .	\$257 47	\$1,032 06
Professional services, . . . . .	837 92	6,051 34
Printing, . . . . .	8 40	8 40
Rates, . . . . .	—	19 08
Freight and express, . . . . .	6 25	3 45
Repairing, . . . . .	—	67 42
Machinery, appliances and hard-		
supplies, . . . . .	5 40	35 68
Tools, ironwork and metals, . . . . .	4 00	216 16
Pipes and valves, . . . . .	—	222 09
Oil and waste, . . . . .	2 40	98 96
Fuel, . . . . .	20 07	65 05
Transport, . . . . .	—	367 15
Tools, . . . . .	—	24 75
Supplies, . . . . .	23 50	3 00
Various expenses, . . . . .	97 62	38 19
	1,271 93	488 68
<i>Construction — Contracts.</i>		
Contracts completed and final payments		
prior to Dec. 1, 1906, . . . . .	—	\$117,818 66
Contract No. 1, Holbrook, Cabot & Rol-		
l Corporation, . . . . .	\$133,268 70	541,978 53
Contract No. 2, United States Wood Pre-		
ssing Co., . . . . .	750 00	5,532 52
Contract No. 3, Henry R. Worthington, . . . . .	4,766 50	7,626 40
Contract No. 19, The Scherzer Rolling		
Bridge Co., . . . . .	—	3,500 00
Contract No. 23, Holbrook, Cabot & Rol-		
l Corporation, . . . . .	24,064 95	68,552 93
Accounts carried forward, . . . . .	\$163,780 15	\$745,909 04
	\$119,731 56	\$314,347 42

*Expenditures — Continued.*

	For the Year Ending Nov. 30, 1907.		From Beginning of W to Nov. 30, 1907.	
<i>Amounts brought forward, . . .</i>	\$163,750 13	\$119,731 56	\$745,009 04	\$314,342
<i>Construction — Contracts — Con.</i>				
Contract No. 24, American Bridge Co. of New York, . . .	27,723 81		29,750 00	
Contract No. 25, Coffin Valve Co., . . .	15,900 00		15,900 00	
Contract No. 27, Coffin Valve Co., . . .	4,357 50		4,357 50	
Contract No. 28, Coffin Valve Co., . . .	1,109 50		3,772 30	
Contract No. 30, New Jersey-West Virginia Bridge Co., . . .	15,300 00		15,300 00	
Contract No. 32, Geo. W. Gale Lumber Co., . . .	220 04		3,699 14	
Contract No. 33, Chelmsford Foundry Co., . . .	1,322 24		1,928 71	
Contract No. 34, Geo. McQuesten Co., . . .			54 15	
Contract No. 35, Gibby Foundry Co., . . .	1,047 98		3,295 65	
Contract No. 37, American Ship Windlass Co., . . .	1,575 00		1,575 00	
Contract No. 38, Westinghouse Electric & Manufacturing Co., . . .	2,635 40		2,635 40	
Contract No. 40, Chapman Valve Manufacturing Co., . . .	850 54		850 54	
Contract No. 41, Coffin Valve Co., . . .	6,755 25		6,755 25	
Contract No. 43, The William Cramp & Sons Ship & Engine Building Co., . . .	770 09		770 09	
Contract No. 44, Coleman Bros., . . .	154,383 06		167,828 84	
Contract No. 45, Richard F. Keough, . . .	850 00		850 00	
Contract No. 46, New England Structural Co., . . .	7,380 00		7,380 00	
Contract No. 47, Geo. McQuesten Co., . . .	790 72		790 72	
Contract No. 48, The Lumsden & Van Stone Co., . . .	629 40		629 40	
Contract No. 49, The William Cramp & Sons Ship and Engine Building Co., . . .	1,260 00		1,260 00	
Contract No. 50, Holbrook, Cabot & Rollins Corporation, . . .	70,066 09		70,066 09	
Contract No. 51, Lynch & Woodward, . . .	541 00		541 00	
Contract No. 52, Aberthaw Construction Co., . . .	1,542 48		1,767 79	
Contract No. 53, L. M. Ham & Co., . . .	1,223 00		1,223 00	
Contract No. 54, Coldwell-Wilcox Co., . . .	419 00		419 00	
Contract No. 55, Gibby Foundry Co., . . .	571 01		571 01	
Contract No. 56, Camden Iron Works, . . .	6,060 00		6,060 00	
Contract No. 57, Wm. H. Wood & Co., . . .	2,762 70		2,762 70	
Contract No. 58, Hiram W. Phillips, . . .	3,931 34		3,931 34	
Contract No. 59, The Lockwood Manufacturing Co., . . .	431 97		431 97	
Contract No. 61, Fred A. Houdlette & Son, . . .	1,306 00		1,306 00	
Contract No. 62, Aberthaw Construction Co., . . .	2,375 17		2,375 17	
Contract No. 63, Baltimore Bridge Co., . . .	4,371 55		4,371 55	
Contract No. 64, Gibby Foundry Co., . . .	4,871 00		4,871 00	
Contract No. 65, R. D. Wood & Co., . . .	675 00		675 00	
Contract No. 67, H. P. Converse & Co., . . .	2,155 56		2,155 56	
Contract No. 68, Geo. McQuesten Co., . . .	982 40		982 40	
Contract No. 69, Camden Iron Works, . . .	4,168 36		4,168 36	
Contract No. 70, Patrick McGovern, . . .	2,275 91		2,275 91	
Contract No. 73, H. P. Converse & Co., . . .	1,032 19		1,032 19	
Contract No. 76, Hiram W. Phillips, . . .	739 50		739 50	
Contract No. 77, Gibby Foundry Co., . . .	439 65		439 65	
Contract No. 82, David S. McCabe, . . .	578 00		578 00	
Contract No. 83, F. M. Ferrin, . . .	501 43		501 43	
		523,720 99		1,128,727
<i>Construction — Additional.</i>				
Advertising, . . . . .	\$2 00		\$2 00	
Labor, . . . . .	28,504 23		59,843 10	
Professional services, . . . . .	6 00		208 00	
Traveling, . . . . .	55		1 41	
Freight and express, . . . . .	240 82		364 69	
Jobbing and repairing, . . . . .	267 92		890 68	
Tools, machinery, appliances and hardware supplies, . . . . .	1,390 50		7,064 15	
Castings, ironwork and metals, . . . . .	2,190 61		4,502 52	
<i>Amounts carried forward, . . .</i>	\$32,602 63	\$642,452 55	\$73,476 55	\$1,443,074

*Expenditures — Concluded.*

	For the Year Ending Nov. 30, 1907.		From Beginning of Work to Nov. 30, 1907.	
<i>Amounts brought forward, . . .</i>	\$32,602 63	\$642,453 55	\$73,476 55	\$1,443,074 77
<i>Construction — Additional — Con.</i>				
Iron pipe and valves, . . . . .	660 48		3,961 39	
Paint and coating, . . . . .	657 98		698 89	
Fuel, oil and waste, . . . . .	601 88		1,043 24	
Lumber and field buildings, . . . . .	1,953 72		6,533 84	
Cement and stone, . . . . .	13 00		19 05	
Sand, . . . . .	22 65		62 65	
Municipal and corporation work, . . . . .	35 68		891 60	
Telephone, lighting and power, . . . . .	1,391 45		3,133 02	
Unclassified supplies, . . . . .	39 34		296 83	
Miscellaneous expenses, . . . . .	-		25 65	
		37,978 71		88,926 11
<i>Real Estate.</i>				
Legal and expert, . . . . .	\$217 85		\$550 60	
Care and disposal, . . . . .	146 55		146 55	
Payment <i>pro tanto</i> under chapter 317, Acts of 1904, . . . . .	-		94,735 86	
Settlements, . . . . .	7,750 00		7,750 00	
		8,114 40		103,183 01
<b>Totals, . . . . .</b>	<b>. . .</b>	<b>\$688,545 66</b>		<b>\$1,635,183 89</b>

The foregoing expenditures have been distributed among the various objects or works as follows:—

	For the Year Ending Nov. 30, 1907.	From Beginning of Work to Nov. 30, 1907.
Administration, . . . . .	\$16,557 43	\$61,491 43
Dam, . . . . .	113,175 88	357,296 83
Lock, . . . . .	110,917 77	414,678 19
Temporary bridge and approaches, . . . . .	21,126 98	133,570 07
Drawbridge, . . . . .	41,807 48	74,885 51
Highway, . . . . .	46 20	156 12
Dredging and pile-driving in Basin, . . . . .	7,522 97	27,565 91
Broad Canal, . . . . .	26,632 83	71,472 09
Lechmere Canal, . . . . .	21,884 79	80,596 37
Boston Embankment, . . . . .	195,407 20	219,207 31
Boston Marginal Conduit, . . . . .	119,889 08	228,657 23
Cambridge Marginal Conduit, . . . . .	13,627 10	15,607 84
<b>Totals, . . . . .</b>	<b>\$688,545 66</b>	<b>\$1,635,183 89</b>

*Receipts.*

	For the Year Ending Nov. 30, 1907.	From Beginning of Work to Nov. 30, 1907.
<i>To the Credit of the Loan Fund.</i>		
Buildings, . . . . .	\$3 00	\$3 00
Labor, tools, supplies and reimbursements, . . . . .	206 00	269 00
<i>To the Credit of the Sinking Fund.</i>		
Rents, . . . . .	895 16	1,810 49
<b>Totals, . . . . .</b>	<b>\$604 16</b>	<b>\$2,082 49</b>



## 14 CHARLES RIVER BASIN COMMISSION. [Jan.

The foregoing receipts have been credited to the various objects or works as follows:—

	For the Year Ending Nov. 30, 1907.	From Beginning of Work to Nov. 30, 1907.
Dam, . . . . .	\$400 16	\$1,514 99
Lock, . . . . .	47 56	48 08
Temporary bridge and approaches, . . . . .	42 44	101 44
Drawbridge, . . . . .	81 00	81 00
Dredging and pile-driving in Basin, . . . . .	2 00	2 00
Broad Canal, . . . . .	10 00	10 00
Lechmere Canal, . . . . .	7 00	7 00
Boston Marginal Conduit, . . . . .	14 00	15 00
Totals, . . . . .	\$604 16	\$2,082 49

The report of the Chief Engineer follows.

In Appendix A will be found chapter 465 of the Acts of 1903 (original Charles River Basin Act) and chapters 65 of the Acts of 1905 and 368 and 402 of the Acts of 1906, which amend the same; also chapter 107 of the Resolves of 1904, chapter 158 of the Acts of 1906 and chapter 404 of the Acts of 1907.

Respectfully submitted,

HENRY S. PRITCHETT,  
HENRY D. YERXA,  
JOSHUA B. HOLDEN,  
*Charles River Basin Commission.*

Boston, March 17, 1908.



BOSTON EMBANKMENT — PILES FOR BASIN WALL.

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## REPORT OF THE CHIEF ENGINEER.

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*To the Charles River Basin Commission.*

GENTLEMEN:—The following is a report of the work of the engineering department for the year ending Nov. 30, 1907.

### ORGANIZATION.

Mr. John L. Howard continued in charge of field work as division engineer until Sept. 21, 1907, when he was promoted to the rank of principal assistant engineer.

Mr. Edward C. Sherman, division engineer, continued in charge of designing, drafting and other office work.

Mr. Frederic P. Stearns continued to act as consulting engineer.

Mr. Guy Lowell was consulted in architecture and landscape architecture.

Mr. J. R. Worcester was consulted in regard to lock-gate trucks, and inspected the shopwork on some structural material constructed in Boston.

Mr. Arthur D. Little was consulted in regard to use of lubricants on the lock-gate trucks, which will be submerged in salt water.

Prof. Samuel C. Prescott, of the Massachusetts Institute of Technology, made an expert examination of the condition of the Stony Brook conduits.

Mr. Staunton B. Peck, of Chicago, Ill., was consulted in regard to the design of the lock-gate operating chains.

The engineering force at the beginning of the year numbered 69, and was increased from time to time as the work required, until September 21, when it numbered 83. At the end of the year it numbered 77.

The names of the assistants in the engineering department, not mentioned above, who have been employed for not less than one month, are given below, with the positions last held, together with an indication of the work performed by them:—

George A. Montague, . . .	Rodman.
Frederick J. Welch, . . .	Rodman.
Joseph P. Wood, . . .	Rodman.
Henry H. Damon, . . .	Rodman.
William F. Donovan, . . .	Rodman.
James J. Greene, . . .	Rodman.
Campbell Hunt, . . .	Rodman.
Edward L. Lincoln, . . .	Rodman.
Francis W. K. Smith, . . .	Rodman.
Charles M. Upham, . . .	Rodman.
Ralph W. Wales, . . .	Rodman.
Herbert O. Welsh, . . .	Rodman.
John R. Wolff, . . .	Rodman.
Leon A. Woodward, . . .	Rodman.
Monroe Ames, . . .	Rodman.
Ernest N. Briggs, . . .	Rodman.
Matthew W. Horgan, . . .	Rodman.
George W. Meserve, . . .	Rodman.
Edward T. O'Keefe, . . .	Rodman.
Walter N. Secord, . . .	Rodman.
James McKnight, . . .	Rodman.

***Inspectors.***

Charles E. Baker, Jr., . . .	Engineering inspector, — on dredging.
Leroy P. Henderson, . . .	Engineering inspector, — on dredging.
Henry M. McCue, . . .	Engineering inspector, — on dredging.
Frank I. Barrett, . . .	Inspector, — on pile-driving.
Samuel B. Horton, . . .	Inspector, — on concrete masonry of Boston Marginal Conduit.
Franklin L. Mason, . . .	Inspector, — on Lock and Boston Mar- ginal Conduit masonry, also on timber for lock-gates and stop-planks.
John P. McKnight, . . .	Inspector, — on concrete masonry at sluices.
Samuel Taylor, . . .	Inspector, — on pile-driving.
William A. Kenrick, . . .	Inspector, — on pile-driving.
George O. Souci, . . .	Inspector, — on pile-driving.
Thomas L. Whelan, . . .	Inspector, — on pile-driving and ma- sonry.
Martin F. Culbert, . . .	Inspector, — on masonry.
Walter A. Livermore, . . .	Inspector, — on pile-driving.
Bernard E. Grant, . . .	Assistant inspector and timekeeper.



*Stenographers and Clerks.*

Jennie L. Rawson,	. . .	Stenographer and clerk, — administrative work, accounts and letters.
Mabel F. Paton,	. . .	Stenographer and clerk.
Edith F. White,	. . .	Stenographer and clerk.
Helen B. Choate,	. . .	Stenographer and clerk.
Charlotte L. Briggs,	. . .	Stenographer.
Ruby H. Graves,	. . .	Stenographer.
Mary A. Fisher,	. . .	Stenographer.
Herbert A. Main,	. . .	Stenographer.
William F. Mitchell,	. . .	Stenographer.
William H. Walsh,	. . .	Stenographer.
Alfred Wm. Treen,	. . .	Clerk.
William J. Dresser,	. . .	Messenger.

In addition to the above regular employees, Mr. Herbert L. Sherman, 12 Pearl Street, Boston, continued to have charge of the cement testing; Mr. William R. Conard, of Burlington, N. J., continued in charge of inspection of pipes and specials manufactured in that locality; Stowell & Cunningham, of Albany, N. Y., were employed as inspectors of mill and shop work on structural steel for the drawbridge, lock-gates and other structural material; the Pittsburgh Testing Laboratory, of Pittsburgh, Pa., was employed to inspect the construction of the lock-gate operating machinery; Mr. Squire Howarth, 7 Regent Square, Roxbury, an expert machinist, inspected material being made at various foundries and machine shops; Prof. C. E. Fuller, of the mechanical engineering department of the Massachusetts Institute of Technology, made such physical tests on twisted steel rods, cast iron, bronze, etc., as was necessary to determine that such materials conformed to the specified requirements.

The principal engineering office was continued at 367 Boylston Street, Boston; and the two field offices were continued, one at 12 Bridge Street, East Cambridge, the other at 108 Chestnut Street, Boston.

As the work of transporting the engineering parties from one place to another was too much for one launch, an arrangement was made with Mr. John E. Dwyer, naval architect, 47 Haverhill Street, Boston, to design a new boat, 28 feet long, with

7-foot beam, the machinery to consist of one 15 horse-power make and break, Buffalo motor. When the plans for this launch were completed, bids were asked for, and on February 2 a contract was made with the Baker Yacht Basin, Incorporated for furnishing this launch complete, with the exception of engine and fittings, which were purchased of the Buffalo General Motor Company. The boat was completed, the engine installed and the whole ready for service on May 29. This launch was named "Lechmere," and, combined with "Craigie," the launch previously purchased, has furnished satisfactory transportation to and from all parts of the waterway.

#### DAM AND LOCK.

A considerable portion of the time of the office force was devoted to the preparation of detail drawings for the Dam and Lock, some 68 drawings for this work having been made. The office force was also employed tracing and checking lock-gate operating machinery; making designs for chain supports for this machinery; designing stop-planks for the Lock and sluice; preparing studies and designs for a fender pier at the upper end of the Lock; designing the house over the lower lock gates; designing temporary houses for the pump motors at the Lock and for the temporary installation of the controls for the lock-gates and drawbridge; designing submerged sluice or slides at the upper end of the sluices; designing job end of system for the lock-gate trucks; examining plans for a 25-horse-power pump submitted by the Lawrence Machine Company; designing doors and windows for the sluices, steam piping for the Lock, stoves and guide brackets for miscellaneous gate valve castings, ladders and gratings; preparing schedules of materials for reinforcing concrete; superintending the grinding of the lock-gate castings; the boring of the axle-boxes of the lock-gate trucks; calculations on the centers of gravity of the lock-gates; testing capstans at the Lock; testing gratings for the boiler-house; assisting in the construction of all boat lock-gates, submerged sluices, and plug drain valves; preparing specifications for various materials; and miscellaneous work.



LOCK — STOP-PLANKS AT UPPER END.

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The condition of the work on the Dam and Lock at the end of the year was as follows:

The masonry for the Lock was substantially completed. The tracks for the lock-gates were laid. The lower lock-gate was nearly assembled, and the work of erection of the upper lock-gate was well advanced. The Scherzer rolling lift bridge at the lower end of the Lock was substantially completed.

At the sluices, the concrete work was substantially completed. The sluice-gates were erected, together with all their operating machinery, but the switchboards and controllers had not been installed.

*Coffer-dam at the Boston Side of the River.*

The coffer-dam is still being maintained, as an arrangement was made with the Boston Elevated Railway Company for the construction within it of a portion of the foundations for their piers at the lower end of the Lock, the Boston Elevated Railway Company having engaged the Holbrook, Cabot & Rollins Corporation, contractor for the Dam and Lock, to do this work.

As the larger portion of the work to be done around the Lock by the contractor for the Dam and Lock was completed, the Commission assumed the cost of pumping the Boston coffer-dam, beginning Jan. 1, 1907, and continuing until August 20, when the cost of pumping was assumed by the Boston Elevated Railway Company.

*Lock.*

During the winter of 1906-1907, little construction was done, owing to the extremely cold weather, which began early and continued well into the month of March. The stop-planks for temporary use at both ends of the Lock were fitted to the I-beams and placed in position as soon as the vertical steel girders and the horizontal trusses for their support were erected. Some difficulty was experienced in making the ends of the stop-plank timbers and the angles on the I-beams supporting them come in the same vertical plane, but after several trials were made with rubber gaskets and other devices, it was found that a mixture of glycerine and litharge seemed to give the most satisfactory results. In order to see if the stop-planks would be tight under water pressure, the water was allowed to rise



planks at the upper end of the Lock until between 5 and 6 feet deep, when the water found its way to the under side and was drawn down. By using street sweepings from the temporary bridge, it was found possible to make the planks substantially water-tight.

After some experiments with yellow pine timbers, it was decided to set cast-iron chairs for the rails for the rolling lock-gates directly in the concrete, care being taken to see that the grouting around the chairs was very carefully done.

Concrete masonry was completed at intervals during the year to complete the abutments of the drawbridge and for the foundations for the boiler house and for the manholes for the electric conduits on the east side of the Lock. A portion of the concrete bastions at the lower end of the Lock walls below the drawbridge was removed by the New York Elevated Railway Company, in order to make room for their piers.

Each lock-gate will be operated by two endless chains driven by electric motors with suitable gearing at the rear end of the gate recess and running over idle sprockets at the front end of the recess. These chains are attached to an equalizing beam which is connected by a steel pin to the lock-gate, so that it may be opened or shut according to the direction in which the motors are turned. Detail plans for the machinery were prepared and a contract for furnishing it made with the Link-Belt Company, of Chicago, Ill. Practically all of the material had been completed at the end of the year, but none of it had been delivered.

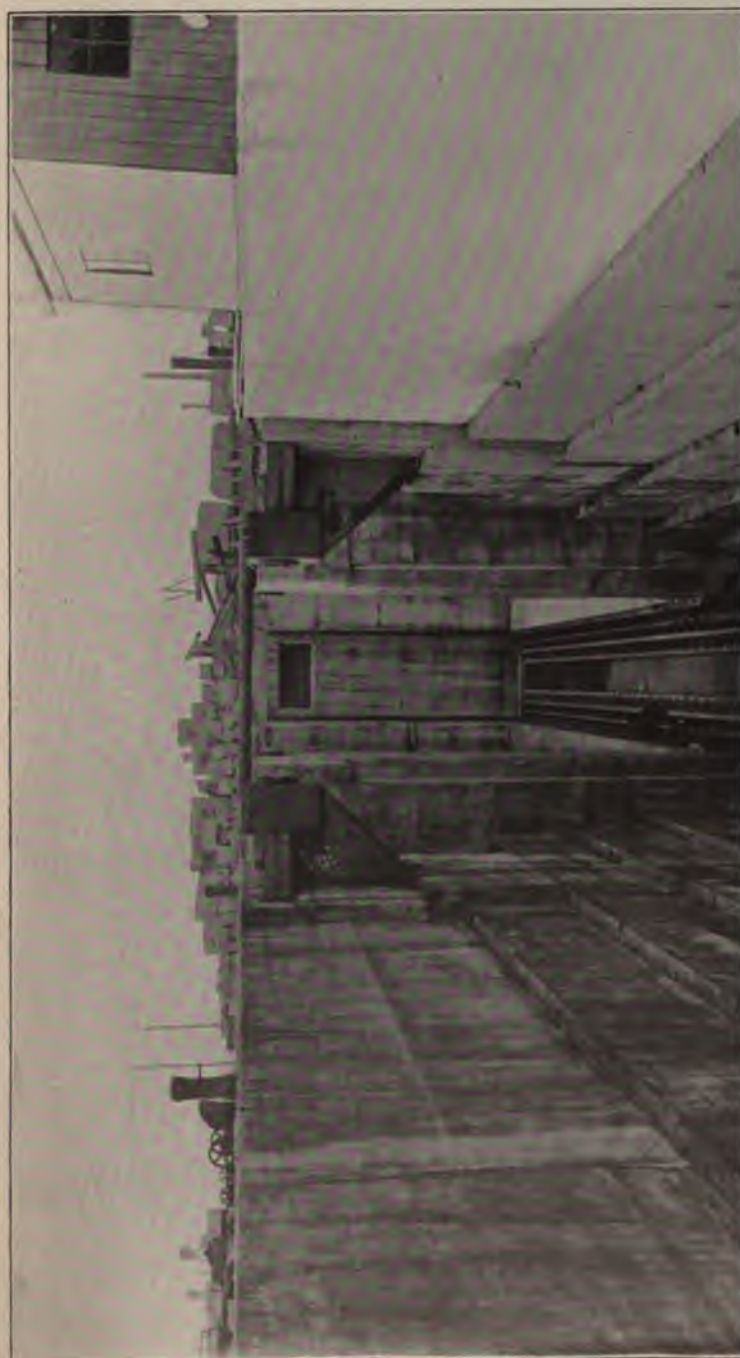
The chains for operating the lock-gates are so heavy that it was deemed inadvisable to use them without supports to prevent them from sagging. Designs for the columns, tracks and other structural steelwork necessary for the lock-gate operating chain supports were prepared and a contract made with the Baltimore Bridge Company, of Baltimore, Md., for furnishing the material. This material had all been delivered at the end of the year.

A contract for furnishing the electrical controlling devices for the lock-gate motors was made with The Cutler-Hammer



LOCK—TOP GIRDER FOR LOWER GATE.

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Manufacturing Company, of Milwaukee, Wis., and that part of the material needed for the preliminary operation of the gates had been delivered at the end of the year.

The material for the lock-gates was received and the work of erection was well along at the end of the year. Before the girder for the top of the lower gate was put in place, the radiators manufactured by The Lumsden & Van Stone Company, of Boston, for heating the various compartments in the gates, were lowered into their respective compartments.

The thirteen sluice-gates to be used on the lock-gates for filling and emptying the Lock were delivered at the site of the work and the work of erection was commenced before the end of the year.

#### *Warping Plant.*

Two electrically operated capstans have been furnished and installed on the easterly side wall of the Lock by the American Ship Windlass Company, of Providence, R. I. These capstans will be used to expedite the progress of vessels through the Lock, so that the delay to street traffic caused by opening the drawbridge may be as slight as possible.

#### *Heating Plant.*

The radiators for heating those parts of the lock-gates upon which ice may form had been delivered upon the work at the end of the year, but they had not been put in place inside the gates.

The boilers to be furnished and erected by Lynch & Woodward were substantially completed.

#### *Superstructures.*

A large amount of time was spent during the year on studies and plans for the houses over the lock-gate recesses, and at the end of the year detail drawings for the house over the lower recess were nearing completion.

As it was necessary to install the pump-motors, controllers and other apparatus which will eventually be enclosed by these buildings, and as this apparatus had to be protected from the weather, small temporary houses were built over the pump-

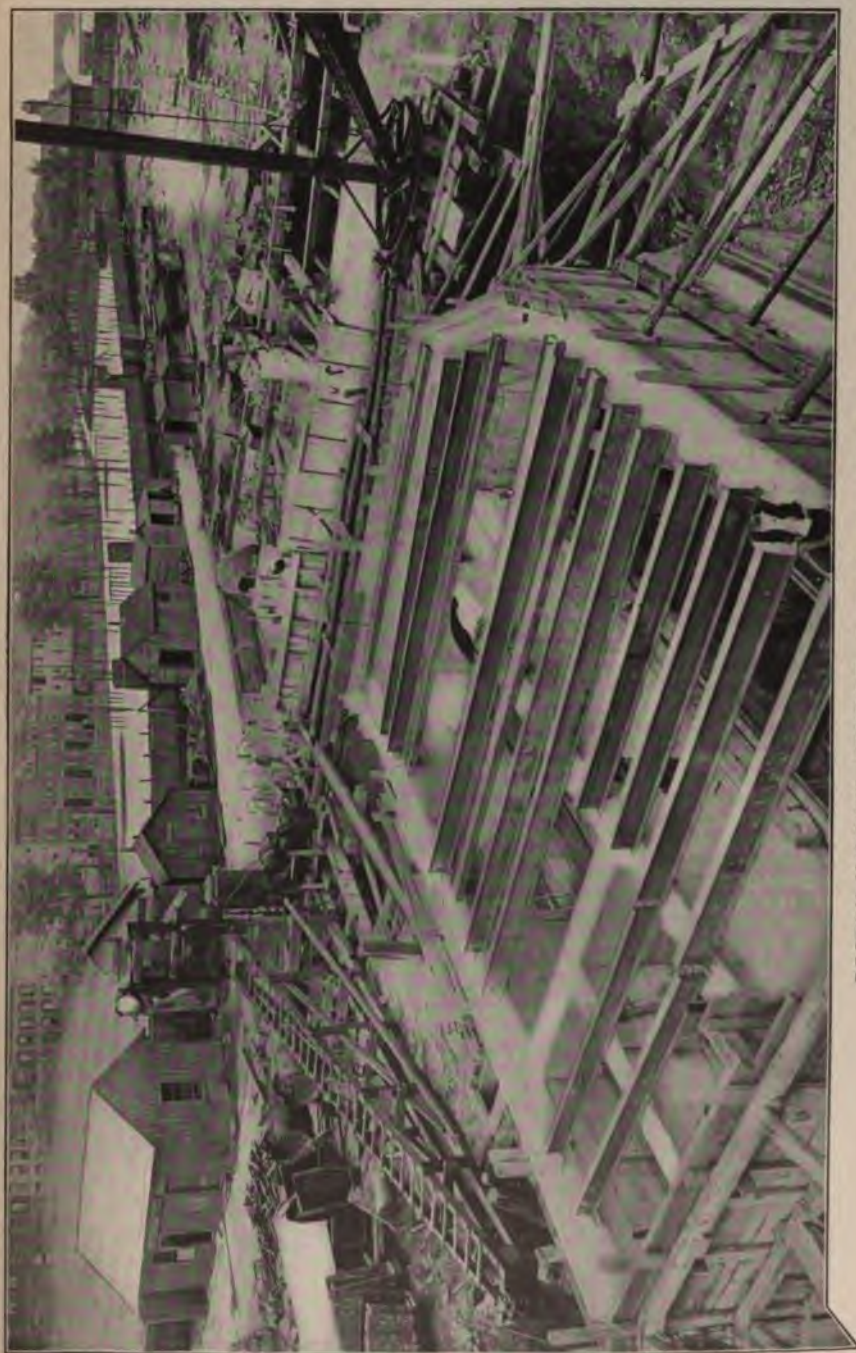
### TEMPORARY BRIDGE.

The temporary bridge and the draw in the same were maintained during the year without any serious delay either to the traffic over the bridge or to navigation through the draw. The winter of 1906-1907 was unusually severe, and some difficulty was found in operating the draw during the coldest weather, on account of the formation of ice on the draw stringers and counterweights. There were two occasions when the gates at the draw were run into and broken by cars of the Boston Elevated Railway Company, once on January 24 and again on February 23, but no person was injured in these accidents. On May 13 a team carrying a load of desks caught fire as it was crossing the bridge, and before the fire could be put out it was necessary to call out the fire department of the city of Cambridge, but the bridge itself was not damaged by the fire. One or two small fires occurred during the dry weather in July and August, but were extinguished before any serious damage was done to the bridge. New cross braces were placed on those pile bents where the old braces had been broken, 20 braces and 73 bolts  $\frac{7}{8}$  inch in diameter being put in.

### BOSTON MARGINAL CONDUIT AND BOSTON EMBANKMENT.

Plans and specifications for Section 5 of the Boston Marginal Conduit and Section 3 of the Boston Embankment were being prepared at the beginning of the period covered by this report. These sections extend from the end of Section 2 of the Boston Embankment, between Fairfield and Gloucester streets, to a point about 50 feet east of Charlesgate East. Competitive bids were not received for this work, an arrangement being made with the Holbrook, Cabot & Rollins Corporation for doing it under Contract No. 50, which originally was made for Section 4 of the Boston Marginal Conduit and Section 2 of the Boston Embankment.

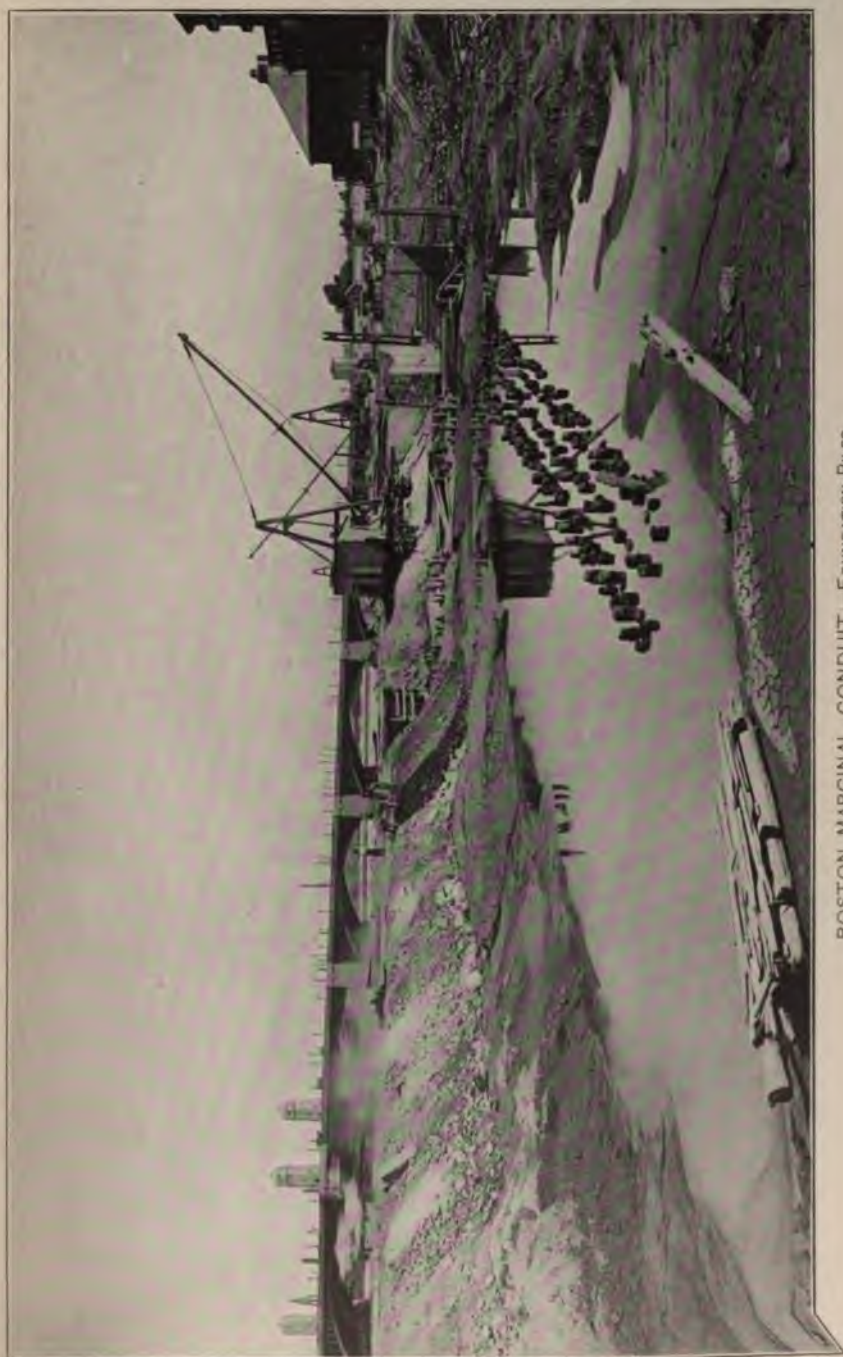
Plans and specifications for the last sections of this work, to be known as Section 6 of the Boston Marginal Conduit and Section 4 of the Boston Embankment, were practically completed at the end of the year. These sections will extend from



BOSTON MARGINAL CONDUIT—OUTLET CHAMBER AT DAM.



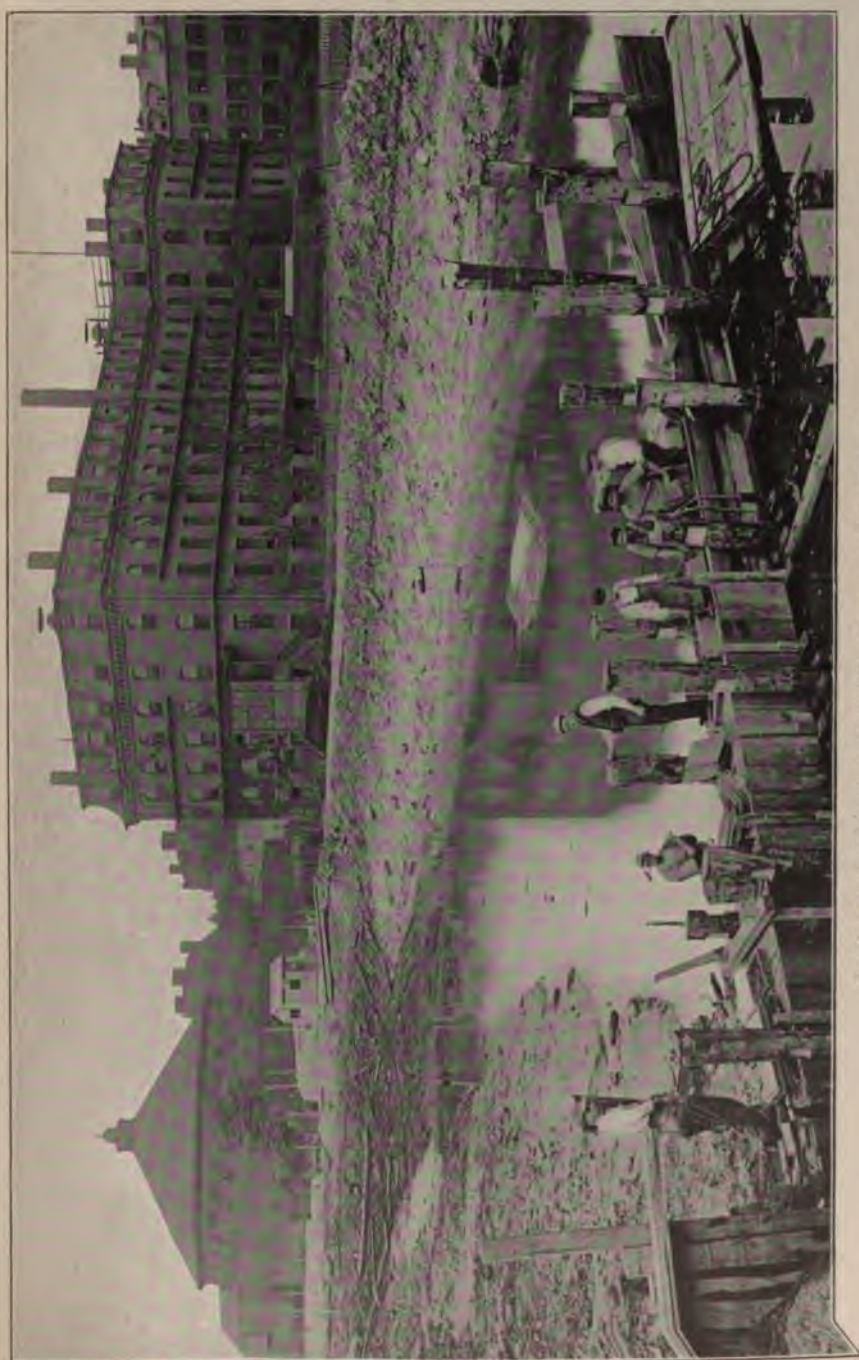




BOSTON MARGINAL CONDUIT—FOUNDATION PILES.







BOSTON MARGINAL CONDUIT—TEMPORARY SEWER OUTLET.





BOSTON MARGINAL CONDUIT—Troughs in Overflow Chamber.

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the end of Section 3 of the embankment near Charlesgate East to the westerly line of Charlesgate West, and the contract will include the construction of the Fens gate-chamber at the junction of the Stony Brook conduits with the Boston Marginal Conduit.

A large amount of time was also spent in revising plans previously made for the Boston Marginal Conduit, on account of the relocation necessitated by the proposed Riverbank subway.

Much study was also required for the timber submerged outlets from the Boston Marginal Conduit overflows, and a design for a timber outlet was prepared, which, it is believed, will prove far more satisfactory than the cast-iron pipes which it was at first intended to use. These timber outlets are to be so built as to give a smooth interior, and as practically no iron or steel is to be used in them their life should be very long. At the end of the year specifications had not yet been prepared for building the submerged outlets from the Boston Marginal Conduit.

Studies for the treatment of the embankment in the vicinity of Harvard Bridge were made. Calculations were made on storage capacities of the Boston Marginal Conduit and Stony Brook conduits.

Section 1, the portion of the marginal conduit adjacent to the Dam, is being constructed by the Holbrook, Cabot & Rollins Corporation. During the year the contractor laid the masonry at the outlets of the conduit and for the extension of the conduit from the upper gate recess to the connection with Section 2, which was built through the Charlesbank by James Driscoll & Son under Contract No. 3.

Section 3 of the Boston Marginal Conduit and Section 1 of the Boston Embankment are being constructed by Coleman Brothers under Contract No. 44. The first section of the conduit, which extended from the new Cambridge Bridge to a point just below Revere Street, was surrounded by an earth embankment early in the year. This section was soon pumped out, and the work of excavating the trench was started.

Before the water could be entirely removed from inside the coffer-dams, it was found necessary to remove a section of the old wall and excavate a trench a short distance below the

bottom of the wall, which was then refilled with clay and gravel well packed together, this reducing the amount of pumping required to such an extent that the enclosed area was kept free from water without difficulty.

As the piles were uncovered by the excavation, it was found that in some places the earth filling had pushed them out of position. Where this movement was less than 12 or 15 inches, it was found practicable to force the piles back into place by means of screw jacks and hold them in place by braces extending from the piles to the sheeting on the side of the trench. In a few places, however, the piles were so far out of place that it was impracticable to restore them to their original position, and 62 new piles were driven to replace those that had moved. Considerable difficulty was experienced in excavating the trench, as the soft mud was forced up in the bottom of it, but by driving long sheeting, which extended a considerable distance below the bottom of the trench, and bracing across below the bottom of the masonry, it was possible to make excavations and construct the conduit, except where the embankment at the side of the sheeting was allowed to get higher on one side than on the other.

As the conduit was constructed to points opposite streets through which sewer overflows existed, concrete masonry connections were made between the conduit and the existing sewer overflow outlets. To take care of the sewer overflows until the completion of the main conduit, temporary wooden outlets on piles were built, extending from the conduit to points 10 or 15 feet beyond the line of the proposed wall. At the end of the year the conduit on this section was completed to within some 150 feet of Mt. Vernon Street, and the temporary and permanent connections made with the overflows at Pinckney and Mt. Vernon streets. All the piles required on this section for the Basin wall were driven from the lower end of the section to Berkeley Street, and the wall masonry, with the exception of the coping, was completed from the lower end of the section to Mt. Vernon Street.

Sections 4 and 5 of the Boston Marginal Conduit and sections 2 and 3 of the Boston Embankment are being constructed by the Holbrook, Cabot & Rollins Corporation under Contract



No. 50. Work under this contract was commenced with a dredge, which excavated material from the river and placed it on the embankment between Dartmouth and Clarendon streets. This work was suspended for the greater portion of February and March on account of ice in the river. Driving piles for the foundation of the Boston Marginal Conduit was commenced early in the spring. These piles were driven by a steam hammer from a floating machine fitted with extension gins and a follower, so that the piles were driven generally to within a foot of the required elevation. After the piles had been driven for several hundred feet, a machine for sawing off piles under water was fitted to the pile-driver and the piles sawed off. This saw was a steel plate 42 inches in diameter, hung from the end of a vertical shaft which was raised or lowered as the tide rose or fell, and which was revolved by a belt connecting a pulley on the vertical shaft with one on the horizontal drum of the engine.

On account of a request from the Boston Transit Commission, the location of the marginal conduit was moved 9 feet out into the river, giving a clear distance of about 40 feet between the conduit and the existing wall of Back Street. This change resulted in a loss of three rows of piles on the 350 feet where piles had already been driven.

The contractor, after building an earth embankment to elevation 114 along the river side of the proposed embankment, attempted to enclose a portion of the site of the proposed embankment some 1,100 feet in length. As soon as the tide rose higher outside than the water on the inside of the enclosure, the difference in head was sufficient to force the water around the end of the dike, through and under the old sea-wall, in such quantities that the two pumps, one 10-inch and one 12-inch, were unable to handle it, and the attempt was abandoned. In order to stop the leak around the lower end of the enclosure, a trench was excavated through a part of the old wall, but it was found so difficult to remove the stones at the bottom of the wall that a line of 6-inch yellow pine sheeting was driven to stop the flow at this point. It is probable, however, that this sheeting was split or twisted in passing through the remainder of the stones, as when another attempt

was made to pump out the enclosure, the leakage at this point did not appear to be materially diminished. It was not until the latter part of August or the first of September that this attempt was made, and it seemed a useless endeavor to get the work into condition so that any concrete masonry could be placed before cold weather. The contractor has been driving 4-inch tongued and grooved sheeting on each side of the trench for the conduit, the bottom rangers and braces for which are to be below the bottom of the concrete masonry, the sheeting below a certain grade, and the lower rangers and braces to be left in place.

The temporary wooden outlets at Dartmouth and Fairfield streets were substantially completed at the end of the year, and a beginning had been made in placing the concrete masonry for the permanent connection at Dartmouth Street.

At the end of the year the following work had been done: Piles for the Boston Marginal Conduit had been driven from the lower end of Section 4 to a point about 250 feet above Fairfield Street, and the excavation for the trench for the conduit had been completed from some 50 feet below Charlesgate East to a point about half-way between Clarendon and Berkeley streets.

#### CAMBRIDGE MARGINAL CONDUIT.

The work which is to be known as the Cambridge Marginal Conduit consists of a masonry conduit having an inside cross-section of some 25 square feet and a length of about 1,800 feet and of an inverted siphon made up of two lines of 48-inch cast-iron pipe under Lechmere Canal, the whole extending from the corner of Binney Street and Commercial Avenue to the sluices at the Dam. Stop-plank chambers are provided at both ends of the siphon, so that either pipe may be cut off and the whole flow concentrated in the other. Connection is made with the Basin at the upper end, near Binney Street, so that a flushing stream of clean water may be run through at a considerable velocity whenever necessary.

Studies, designs, plans, estimates and specifications were made for this work, including studies of the hydraulic properties of the conduit.

A contract was made with Patrick McGovern, of Boston, Mass., for building the main portion of the Cambridge Marginal Conduit, and another with Hiram W. Phillips, of Quincy, Mass., for building the inverted siphon.

Considerable difficulty was encountered by the contractor for the main portion of the conduit in driving sheeting for the gate-chambers, as the material through which it was driven in places contained many stones and boulders and the sheeting was so badly split and twisted that it was impossible to keep the water out of the enclosure except at or near low tide. Portions of the sheeting which were the most badly broken were cut off and driven down with a follower as far as possible. After this was done, the work of placing the concrete could be continued for about four hours at low water, an 8-inch pump being used.

The work on the inverted siphon during the year consisted of removing the walls on both sides of the canal and dredging a trench approximately to the grade of the siphon for the greater portion of its length. Sheet piling was also driven on the south side of Lechmere Canal on both sides of the trench where it passes through the old sea-wall, and a few piles for supporting the pipes were driven.

#### DREDGING AND PILE-DRIVING IN THE BASIN.

Some 20,000 cubic yards were dredged from the Basin under Contract No. 1, with the Holbrook, Cabot & Rollins Corporation, partly on the Cambridge side of the Basin and partly on the Boston side near the Dam, of which 8,000 cubic yards were deposited in the Boston Embankment and the remainder was deposited in storage piles below the new Cambridge Bridge.

The number of piles driven in the Basin by the Holbrook, Cabot & Rollins Corporation under Contract No. 23 was 146. At the end of the year oak piling had been driven in front of 918 linear feet of walls and wharves in the Basin.

#### BROAD AND LECHMERE CANALS.

The work of dredging was continued by the Holbrook, Cabot & Rollins Corporation under Contract No. 1. Some 48,000 cubic yards were dredged from Broad Canal and 6,000 cubic



yards from Lechmere Canal. Of this material, about 32,000 cubic yards were deposited in the Boston Embankment, about 5,000 cubic yards were deposited in the Dam, and the remainder was deposited in storage piles below the new Cambridge Bridge.

The driving and capping of piles in front of properties on Broad and Lechmere canals by the Holbrook, Cabot & Rollins Corporation under Contract No. 23 was continued at various times, and at the end of the year the piles had been driven in front of all the properties in Broad Canal, except the Tower property and the portion of the property of the Geo. G. Page Box Company above the railroad bridge, making a total of 5,710 linear feet of walls and wharves in front of which oak piles had been driven in Broad Canal. The piles in Lechmere Canal were all driven, except on a portion of the Peters estate and on that portion of the Scully property on the south side of the canal and west of Commercial Avenue where a location for the bulkhead line has not been settled, making a total of 3,036 linear feet of walls and wharves in front of which oak piles had been driven in Lechmere Canal.

The work of lowering the inverted sewer siphon under Lechmere Canal in Commercial Avenue was performed by Hiram W. Phillips, of Quincy, Mass. Before commencing the work, the flow of the sewer was diverted through the Bridge Street sewer and discharged directly into the river, between the old sea-wall and the Cambridge coffer-dam. Before interfering with the existing siphon, a test was made of the amount of leakage into the siphon at high water when it was pumped out. This was found to be at the rate of about one cubic foot per minute. While dredging was in progress to uncover the existing siphon, two portions of the wall on the northerly side of the canal fell in. One section, immediately adjoining the Wellington-Wild coal wharf, was about 20 feet in length; the other, near the easterly side of Commercial Avenue, was about 30 feet in length. Dredging at this point was then suspended, and a line of 4-inch splined sheet-piling was driven, extending from the line of the Wellington-Wild coal wharf to the sheeting for the old siphon, and the foundation stones of the wall at the corner of the Wellington-Wild coal wharf were relaid and

the joints filled with spawls and pinners driven tightly into place. After the dredging was completed, the pipes at the ends of the siphon were cut. Slings were passed under the siphon box and the box was raised and towed to the up-stream slope of the Cambridge coffer-dam, where the ends were cut off and made the proper length for the new siphon. While this was being done, the trench was dredged to the required grade of the new siphon, the siphon was lowered, and connections at the end made. A test showed that the leakage was greater than before the work was started. It was only with great difficulty that the leak was found and stopped, when another test showed the leakage to be about one-half the amount of the leakage in the original siphon.

#### LAND TAKINGS.

For the right to drive piles and to dredge in the canals in front of properties whose owners had not signed releases, the following taking plans were made:—

Plan of land of Annie B. Matthews and Sarah M. Fay on Broad Canal, between Third and Sixth streets.

Plan of land of heirs of Howard Coon on Broad Canal, between First and Third streets.

Plan of land of Walter J. Connery and Walter A. Wentworth on Broad Canal, between Third and Sixth streets.

Plan of land of the Sylvester Tower Company on Broad Canal, above Sixth Street.

Plan of land of Mary A. Linehan on Lechmere Canal, about 200 feet west of Commercial Avenue.

For the right to construct the marginal conduit through a corner of the property, a taking plan was made of land of the Massachusetts Charitable Eye and Ear Infirmary adjacent to the old sea-wall of the Charles River adjoining the new Cambridge Bridge.

#### BORINGS.

In December arrangements were made with the Charles R. Gow Company for making a few borings by day labor on the location of the proposed rest pier at the upper end of the Lock, and four borings were made to a net depth of 68.6 linear feet.

In January an agreement was made with the Charles R. Gow Company for making borings from a scow in the river near the proposed outlets from the Cambridge and the Boston marginal conduits at the rate of \$1.00 per linear foot. Under this agreement fourteen borings were made to a depth of 453.5 linear feet.

In April an agreement was made with B. F. Smith & Brother for making borings on the line of the Cambridge Marginal Conduit at the rate of \$0.40 per linear foot. Under this agreement thirteen borings were made to a total depth of 405 $\frac{1}{4}$  linear feet.

#### UPLAND FLOW OF THE CHARLES RIVER.

A recording gage, showing the depth of water flowing over the dam at the Waltham Bleachery, was maintained, and weekly current meter observations were taken of the flow in the canal past the Bleachery Dam.

Table No. 1 shows the estimated average flow of the Charles River at the Waltham Bleachery for weekly periods. The area of the watershed above the Waltham Bleachery is taken to be

169 square miles; this excludes 70 square miles assumed to be tributary to Mother Brook and 24 square miles tributary to the Cambridge reservoirs. Whenever these reservoirs overflowed into the Charles, the amount, as furnished by Mr. L. M. Hastings, city engineer of Cambridge, has been deducted from the total discharge measured at the Waltham Bleachery.

Table No. 2 shows the number of days during the year ending Nov. 30, 1907, when the upland flow of the Charles River at the site of the Dam, estimated from the records kept by the Charles River Basin Commission at the Waltham Bleachery, was more than 500 cubic feet per second for twenty-four hours.

Table No. 3 shows the length of time during which the water in the Harbor under normal tide conditions will be higher than the water in the Basin, and the rise of the Basin during that interval for various rates of upland flow.

Diagram No. 1 shows the daily flow of the Charles River at the Waltham Bleachery, in connection with the rainfall at Chestnut Hill, taken from the records of the Metropolitan Water Works.

TABLE NO. 1.—*Estimated Weekly Average Flow of Charles River at the Waltham Bleachery for the Year ending Nov. 30, 1907.*

WEEK ENDING—	Cubic Feet per Second.	Cubic Feet per Second per Square Mile. <sup>1</sup>	WEEK ENDING—	Cubic Feet per Second.	Cubic Feet per Second per Square Mile. <sup>1</sup>
<b>1906.</b>			<b>1907.</b>		
Dec. 8, . . .	193	1.14	June 8, . . .	292	1.73
15, . . .	180	1.06	15, . . .	255	1.51
22, . . .	105	0.62	22, . . .	164	0.97
29, . . .	145	0.86	29, . . .	122	0.72
<b>1907.</b>			July 6, . . .	83	0.49
Jan. 5, . . .	311	1.84	13, . . .	41	0.24
12, . . .	487	2.68	20, . . .	44	0.26
19, . . .	421	2.49	27, . . .	43	0.25
26, . . .	406	2.40	Aug. 3, . . .	43	0.25
Feb. 2, . . .	390	2.31	10, . . .	29	0.17
9, . . .	231	1.37	17, . . .	24	0.14
16, . . .	205	1.21	24, . . .	23	0.13
23, . . .	205	1.21	31, . . .	19	0.11
Mar. 2, . . .	141	0.83	Sept. 7, . . .	15	0.09
9, . . .	181	1.07	14, . . .	30	0.18
16, . . .	190	1.12	21, . . .	49	0.29
23, . . .	547	3.24	28, . . .	60	0.36
30, . . .	586	3.47	Oct. 5, . . .	135	0.80
Apr. 6, . . .	420	2.49	12, . . .	222	1.31
13, . . .	419	2.48	19, . . .	147	0.87
20, . . .	498	2.95	26, . . .	101	0.60
27, . . .	403	2.38	Nov. 2, . . .	96	0.57
May 4, . . .	300	1.78	9, . . .	249	1.47
11, . . .	256	1.51	16, . . .	398	2.36
18, . . .	317	1.88	23, . . .	274	1.62
25, . . .	276	1.63	30, . . .	376	2.23
June 1, . . .	215	1.27			

<sup>1</sup> Area of watershed is 169 square miles.

TABLE NO. 2.—*Number of Days during Year ending Nov. 30, 1907, when Estimated Upland Flow of Charles River at the Site of the Dam was More than 500 Cubic Feet per Second for Twenty-four Hours, from Records kept by the Charles River Basin Commission at the Waltham Bleachery.*

MONTH.	500-750 Cubic Feet per Second (Days).	750-1,000 Cubic Feet per Second (Days).	1,000-1,500 Cubic Feet per Second (Days).	1,500-2,000 Cubic Feet per Second (Days).	2,000-2,500 Cubic Feet per Second (Days).	Total Number of Days exceeding 500 Cubic Feet per Second.	Rainfall at Chestnut Hill (Inches).	Average Rainfall on Sudbury Watershed for Thirty-two Years (Inches).
<b>1906.</b>								
December, . . .	-	-	-	-	-	-	5.36	3.84
<b>1907.</b>								
January, . . .	20	1	-	-	-	21	3.80	4.19
February, . . .	1	-	-	-	-	1	3.31	4.22
March, . . .	4	10	-	-	-	14	2.44	4.60
April, . . .	19	3	-	-	-	22	3.72	3.56
May, . . .	-	-	-	-	-	-	4.06	3.35
June, . . .	-	-	-	-	-	-	3.39	3.17
July, . . .	-	-	-	-	-	-	1.49	3.72
August, . . .	-	-	-	-	-	-	1.79	3.98
September, . . .	-	-	-	-	-	-	10.02	3.43
October, . . .	-	-	-	-	-	-	3.65	4.12
November, . . .	10	-	-	-	-	10	7.91	3.86
Totals, . . .	54	14	-	-	-	68	50.94	46.04
1905-06, <sup>1</sup> . . .	29	26	-	-	-	55	50.11	-
1904-05, <sup>2</sup> . . .	21	25	5	-	-	51	39.10	-
1903-04, <sup>2</sup> . . .	29	18	13	5	1	66	45.98	-

The estimated flow at the site of the Dam was obtained from that at the Waltham Bleachery by applying the yield per square mile given in Table No. 1 and adding the waste from the Cambridge reservoirs watershed as obtained from the records kept by the city of Cambridge.

<sup>1</sup> 14 months.

<sup>2</sup> One year.



TABLE NO. 3.—*Time during which the Water in the Harbor under Normal Tide Conditions will be Above the Water in the Basin, and Rise of Basin during that Interval for Various Rates of Upland Flow.*

Rate of Upland Flow (Cubic Feet per Second).	Time Harbor will be Above Basin.		Rise of Basin (Feet).	Rate of Upland Flow (Cubic Feet per Second).	Time Harbor will be Above Basin.		Rise of Basin (Feet).
	Hrs.	Min.			Hrs.	Min.	
500	3	48	.20	3,000	3	19	1.02
1,000	3	42	.39	4,000	3	8	1.28
1,500	3	36	.56	5,000	2	58	1.51
2,000	3	30	.72	6,000	2	49	1.71
2,500	3	25	.87				

#### TRAFFIC THROUGH DRAW OF CRAIGIE BRIDGE AND OF TEMPORARY BRIDGE.

A record has been kept of the traffic through the draw of the temporary bridge. This record gives the tonnage, draft and time of passage of vessels of different kinds. Some of the results of the records obtained are shown by the following diagrams:—

Diagram No. 2 shows weekly totals of cargoes, in tons, not including the material furnished for the Charles River Dam, passing through the temporary bridge for the year ending Nov. 30, 1907.

Diagram No. 3 shows the monthly totals of cargoes, in tons, not including the material furnished for the Charles River Dam, passing through Craigie Bridge or the temporary bridge since Nov. 30, 1899. This diagram indicates a general tendency of the tonnage to decrease from year to year.

Diagram No. 4 shows the yearly number of vessels passing through Craigie Bridge or the temporary bridge since Sept. 30, 1885, and the number of times the draw has been opened per year since Sept. 30, 1871, the only complete years covered by existing records.

## MISCELLANEOUS ENGINEERING WORK.

One hundred and thirty-eight finished plans were made during the year, in addition to a large number of studies and sketches. One hundred and ninety-nine plans were indexed and filed, which, with the plans previously filed, make a total of 895 plans.

One hundred and forty-five photographs were taken by Mr. Luther H. Shattuck.

Observations were taken of the elevation to which sewer overflows rise at times of high water, and the usual miscellaneous work of soundings and surveys was done.

## CONTRACTS.

Thirty-three contracts were made during the year. The preparation of the various contract plans, specifications and estimates, supervision of the work, etc., occupied a considerable portion of the time of the engineering force. A detailed statement of the contracts made and pending during the year is given in Appendix B.

Following are additional descriptions of some of these contracts, except so far as the work done under them has already been described under the headings of "Dam and Lock," "Boston Marginal Conduit and Boston Embankment," "Cambridge Marginal Conduit," "Dredging and Pile-driving in the Basin" and "Broad and Lechmere Canals."

*Contract No. 1, Holbrook, Cabot & Rollins Corporation. — Dam and Lock in the Charles River, Boston and Cambridge.*

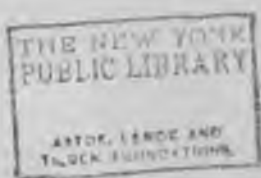
On Jan. 14, 1905, a contract was made with the Holbrook, Cabot & Rollins Corporation for the construction of the Dam and Lock. A general description of the work to be done under this contract is given in the report for the year ending Sept. 30, 1905.

The following is a summary of the work of the current year: —

On April 12 all the stop-planks were in place at the upper end, and on May 21 all were in place at the lower end, of the Lock.



LOCK — LOOKING NORTH.



On March 1 the driving of piles for the Harbor wall between the Lock and the Boston Marginal Conduit was resumed.

On March 22 concrete work was started again with the mixer in a new location, just below the Harbor wall and about half-way between the Lock and the Boston Marginal Conduit.

The work of drilling holes preliminary to cutting off concrete at the lower end of the Lock, made necessary by the location of the Boston Elevated Railway, was started on July 30.

Work at the sluices was resumed on April 11, and the principal work on the sluices was completed about the first of August, very little work being done there during the year after that date.

The total value of the work performed, as shown by the November, 1907, estimate, was \$581,978.53, the principal items of which were as follows:—

Coffer-dam at the Boston end, . . . . .	90 per cent. completed. <sup>1</sup>
Coffer-dam at the Cambridge end, . . . . .	90 per cent. completed. <sup>1</sup>
Earth excavation, . . . . .	375,326 cu. yds.
Round piles in place (exclusive of coffer-dams), . . . . .	306,500 lin. ft.
Spruce lumber in place, . . . . .	139.67 M. ft. B. M.
Concrete masonry, . . . . .	36,320 cu. yds.
Granolithic surfacing, . . . . .	1,240 sq. yds.
Ashlar masonry, . . . . .	348 cu. yds.
Dimension stone masonry, . . . . .	135 cu. yds.
Face dressing, . . . . .	5,600 sq. ft.
Iron and other metal work placed, . . . . .	706.283 tons.
Special work, . . . . .	\$14,062.97
Extra work, . . . . .	64,904.28

*Contract No. 2, United States Wood Preserving Company.—  
Wooden Block Paving for Temporary Bridge, Boston and  
Cambridge.*

On March 23, 1905, a contract was made with the United States Wood Preserving Company for furnishing and laying the wooden block paving for the temporary bridge.

No additional work was done under this contract during the year, and a final estimate was made with the contractor under date of April 26, 1907, for \$750, making the total amount paid on the contract \$5,532.52.

<sup>1</sup> Assumed not completed until removed.



*Contract No. 5, Henry R. Worthington. — Furnishing and erecting Pumps, Boston and Cambridge.*

On Sept. 30, 1905, a contract was made with Henry R. Worthington for furnishing and erecting pumps. A description of the work called for under this contract is given in the report for the year ending Sept. 30, 1905.

The three pumps called for under this contract had all been erected but had not been tested at the end of the year.

The total amount paid to the end of the year was \$7,626.40.

*Contract No. 23, Holbrook, Cabot & Rollins Corporation. — Furnishing, driving and capping Piles, Cambridge.*

On Dec. 4, 1905, a contract was made with the Holbrook, Cabot & Rollins Corporation for piles along the walls of the canals and Basin in Cambridge.

Work on this contract was substantially completed at the end of the year.

The value of the work done, as shown by the November, 1907, estimate, was \$74,768.15. The principal items of work performed were as follows: —

Oak piles in place, . . . . .	4,400.
Long-leaf yellow pine in place, . . . . .	113.7 M. ft. B. M.
Iron or steel in place, . . . . .	88,266 pounds.
Extra work, . . . . .	\$4,002.47

*Contract No. 24, American Bridge Company of New York. — Constructing a Scherzer Rolling Lift Bridge, Boston.*

On March 5, 1906, bids were received for the construction of a Scherzer rolling lift bridge, and on March 16, 1906, a contract was made with the American Bridge Company of New York for the construction of this bridge for \$40,800.

On Feb. 1, 1907, the work of erecting the drawbridge was started, and the erection of the steel was nearly finished by April 1. At the end of the year, the machinery was in place and the bridge substantially completed.

The value of the work done at the end of the year, as shown by the October, 1907, estimate, was \$35,000.

*Contract No. 25, Coffin Valve Company. — Furnishing Sluice-gates at the Sluices in the Dam, Cambridge.*

On March 16, 1906, a contract was made with the Coffin Valve Company for the large gates for the sluices, for the sum of \$24,800.

With the exception of the electrical controlling apparatus, this work was nearly completed at the end of the year.

The value of the work done at the end of the year, as shown by the November, 1907, estimate, was \$21,200.

*Contract No. 27, Coffin Valve Company. — Furnishing Sluice-gates on the Lock-gates in the Lock, Boston.*

On March 6, 1906, a contract was made with the Coffin Valve Company for furnishing the sluice-gates on the lock-gates at the Lock, for the sum of \$17,093.

The erection work on these gates was commenced on November 8 and was continued until the end of the year. The value of the work done at that date was, as shown by the March, 1907, estimate, \$5,810, no additional material having been delivered between the date of that estimate and the end of the year.

*Contract No. 28, Coffin Valve Company. — Furnishing Tide-gates at the Dam and Lock, Boston and Cambridge.*

On March 16, 1906, a contract was made with the Coffin Valve Company for furnishing and erecting twenty-five tide-gates at the Dam and Lock, the contract price for the gates being \$4,438.

The gates called for under this contract had all been erected at the end of the year. The amount paid on this contract, as shown by the January, 1907, estimate, was \$3,772.30, the work, with the exception of the final adjustment of the tide-gates, having been substantially completed at that date.

*Contract No. 30, New Jersey-West Virginia Bridge Company. — Constructing Lock-gates, Boston.*

On May 14, 1906, bids were opened for the construction of the rolling lock-gates in the Lock, and on June 13, 1906, a contract was made with the New Jersey-West Virginia Bridge Company for this work, the price to be \$26,784.

On Oct. 1, 1907, a derrick was erected for handling the material for the lower lock-gate. On November 21 the derrick was removed from the lower to the upper gate recess, for the purpose of erecting the upper lock-gate.

At the end of the year the work of erecting and riveting the gates was in progress. The value of the work done at that date, as shown by the November, 1907, estimate, was \$18,000.

*Contract No. 37, American Ship Windlass Company. — Furnishing and erecting Electric Dock Capstans at Lock, Boston.*

On May 24, 1906, a contract was made with the American Ship Windlass Company for two capstans for warping vessels through the Lock, for the sum of \$2,100.

On March 8, 1907, an estimate for 75 per cent. of the contract price, amounting to \$1,575, was made, this work being substantially completed, with the exception of erecting and testing the capstans.

The two capstans called for under this contract were received Aug. 31, 1907, and on September 20 the capstans had been erected and the local wiring completed. On October 14 a test was made to determine whether they complied with the specifications of the contract.

*Contract No. 38, Westinghouse Electric and Manufacturing Company. — Furnishing Motors for operating Lock-gates, Boston.*

On May 25, 1906, a contract was made with the Westinghouse Electric and Manufacturing Company for four motors, for the sum of \$2,635.40.

Two of the motors were delivered Jan. 8, 1907, and the other two Feb. 16, 1907. A voucher for the final payment was approved Feb. 25, 1907.

*Contract No. 41, Coffin Valve Company. — Furnishing Sluice-gates at the Sluices and Boston Marginal Conduit, Cambridge and Boston.*

On June 14, 1906, a contract was made with the Coffin Valve Company for six sluice-gates at the Dam and Lock, for the sum of \$11,862.



BOSTON MARGINAL CONDUIT — VIEW NEAR REVERE STREET, SHOWING TRENCH.





These gates, with their appurtenances, with the exception of a portion of the operating machinery and electrical control, were delivered.

The value of the work done, as shown by the October, 1907, estimate, was \$9,007.

*Contract No. 44, Coleman Brothers. — Section 3 of the Boston Marginal Conduit and Section 1 of the Boston Embankment, Boston.*

On Sept. 24, 1906, a contract was made with Coleman Brothers for this work.

The work of filling continued without much interruption during the winter of 1906–1907.

On March 20, 1907, the work of placing the concrete masonry, which had been discontinued during the winter, was resumed.

The first section was completely surrounded by an earth dam on April 8. This area was pumped out on April 9. The second area, extending to a point a short distance below Pinckney Street, was pumped out on June 22; the third area, extending to a point near Mt. Vernon Street, on August 10; and the fourth area, extending nearly to Berkeley Street, on November 4.

In November, 1906, eight piles were driven for the Basin wall, but as they moved out of position, this work was abandoned until May 22, when the work was resumed.

The work of constructing the Basin wall on the piles already driven was commenced on July 18, 1907.

The total value of the work done, as shown by the November, 1907, estimate, was \$197,445.69, the principal items of which were as follows:—

Earth excavation and refill,	. . . . .	165 lin. ft.
Earth filling,	. . . . .	376,145 cu. yds.
Piles in place,	. . . . .	154,834 lin. ft.
Drains,	. . . . .	1,657 lin. ft.
Concrete masonry,	. . . . .	3,249 cu. yds.
Ashlar masonry,	. . . . .	171.3 cu. yds.
Sheeting left in place,	. . . . .	218.5 M. ft. B. M.

#### 44 CHARLES RIVER BASIN COMMISSION. [Jan.

Yellow pine lumber in place in sewer outlets, . . . . .	48 M. ft. B. M.
Wrought iron and steel in place in sewer outlets, . . . . .	15,803 pounds.
Iron and other metal work in place, . . . . .	41.8 tons.
Extra work, . . . . .	\$1,314.79

*Contract No. 48, The Lumsden & Van Stone Company. — Furnishing and erecting Steam, Water and Air Piping, Boston.*

On Oct. 20, 1906, a contract for this work was made with The Lumsden & Van Stone Company for \$2,098.

A large proportion of the material to be furnished under this contract had been delivered at the close of the year, but erection had not been commenced.

The amount of the November, 1907, estimate was \$629.40.

*Contract No. 50, Holbrook, Cabot & Rollins Corporation. — Sections 4 and 5 of the Boston Marginal Conduit and Sections 2 and 3 of the Boston Embankment, Boston.*

On Nov. 5, 1906, a contract was made with the Holbrook, Cabot & Rollins Corporation for this work.

On April 3, 1907, an agreement was made with the contractor to extend this contract 2,000 feet farther up the river, the prices to be the same as on the original contract.

On April 4 the contractor was notified to suspend the work of driving piles in the Boston Marginal Conduit pending a decision of the Boston Transit Commission as to the location of the Riverbank subway. On April 10, this matter being settled, the work was resumed.

The total value of the work done, as shown by the November, 1907, estimate, was \$82,430.69, the principal items of which were as follows:—

Earth filling, . . . . .	116,670 cu. yds.
Piles in place, . . . . .	107,037 lin. ft.

*Contract No. 51, Lynch & Woodward. — Furnishing and erecting a Boiler Plant, Boston.*

On Nov. 12, 1906, bids were opened for erecting a boiler plant at the Lock, and on Dec. 4, 1906, a contract was made with Lynch & Woodward for \$2,164.



BOSTON MARGINAL CONDUIT—SHEETING FOR TRENCH.



The work to be done under this contract consisted in furnishing and erecting, sound and complete in all respects, a boiler plant comprising two boilers with settings, grates, fronts, feed and blow-off piping, gages, uptakes, dampers, flue, etc., all complete and erected ready to generate steam.

The boilers called for by this contract were delivered in the spring of 1907, but the erection was deferred until the autumn, on account of other work at the Lock.

Work on the foundations of the boilers was started on November 18. At the end of the year the boilers were in place and nearly ready for use, and a payment of \$541 had been made on the contract.

*Contract No. 57, William H. Wood & Company. — Furnishing Spruce Lumber for repairing Temporary Bridge.*

Bids were received for the estimated quantity of lumber required for repairing the temporary bridge to Jan. 1, 1908, and on Feb. 4, 1907, a contract was made with William H. Wood & Company, at a price of \$21 per M. ft. B. M. for both 2-inch and 3-inch plank. The estimated quantity to be required was 140 M. ft. B. M. of 2-inch and 10 M. ft. B. M. of 3-inch spruce plank.

This material was delivered throughout the year as needed for repairs on the bridge.

*Contract No. 58, Hiram W. Phillips. — Lowering the Commercial Avenue Sewer Siphon under Lechmere Canal, Cambridge.*

Bids were received for lowering the Commercial Avenue sewer siphon, and on Feb. 13, 1907, a contract was made with Hiram W. Phillips for this work for \$3,150, with the provision that if quicksand were encountered an additional cost, not to exceed \$600, would be allowed for driving sheeting.

On March 1 a pulsometer began the work of pumping out the shafts at each end of the siphon. On April 2 the box was raised and the necessary changes made, on April 18 the siphon was lowered into position, and on April 30 the connections at the ends of the siphon were made.



The work was completed and a final estimate made on May 10, 1907, the total amount paid being \$3,931.34.

*Contract No. 59, The Lockwood Manufacturing Company. — Furnishing and erecting a Timber Ice-run Sluice-gate, Boston.*

On May 27, 1907, bids were opened for the timber ice-run gate for the upper lock-gate, and on June 3 a contract was made for this work with The Lockwood Manufacturing Company for \$847.

The work to be done under this contract was completed in the shop and ready for installation during the year, and a payment amounting to \$431.97 was made.

*Contract No. 60, Link-Belt Company. — Furnishing Lock-gate Operating Machinery, Boston.*

On April 15, 1907, bids were opened for the operating machinery for the lock-gates at the Lock, and on April 23 a contract was made with the Link-Belt Company for \$10,000.

The work to be done under this contract was nearly completed in the shop, but no material was delivered during the year and no payment made.

*Contract No. 63, Baltimore Bridge Company. — Furnishing Lock-gate Operating Chain Supports, Boston.*

On April 22, 1907, bids were received, and on May 9, 1907, a contract was made with the Baltimore Bridge Company, of Baltimore, Md., for the lock-gate operating chain supports. The full amount of the contract, including some additional material, was \$5,143.

All the material to be furnished under this contract was delivered during the year, and \$4,371.55 was paid on the contract.

*Contract No. 64, Gibby Foundry Company. — Furnishing Castings, Boston.*

On March 19, 1907, bids were opened for castings, and on March 21, 1907, a contract was made with the Gibby Foundry Company for \$4,871.

The work consisted of making and delivering the cast-iron rail chairs for the lock-gate tracks.

This contract was completed and final payment made during the year.

*Contract No. 66, The Cutler-Hammer Manufacturing Company. — Furnishing Controlling Devices for Operating Motors of Main Lock-gates, Boston.*

On May 22, 1907, a contract was made with The Cutler-Hammer Manufacturing Company for furnishing the electrical control for operating the motors for the main lock-gates, the amount being \$2,958.

The work to be done consisted in furnishing, ready for erection, with all the necessary instruments, appliances, etc., one main switchboard panel; two 2 by 50 horse-power 500-volt, multiple contactor type, series parallel controllers, including resistances, master controllers and limit switches; two auxiliary spare controllers, manually operated for series control only, including drums and resistances, and two indicating lamp panels.

Part of the material to be furnished under this contract was delivered during the year, but no payment was made.

*Contract No. 68, George McQuesten Company. — Furnishing Yellow Pine Lumber for Stop-planks, Boston and Cambridge.*

Bids were received, and on May 31, 1907, the contract was placed with the George McQuesten Company for furnishing and delivering about 23,000 feet B. M. of Georgia or Florida long-leaf yellow pine of the quality known as "prime," inspection according to the interstate rules of 1905, approved Dec. 10, 1904. The price named in the contract was \$40 per M. ft. B. M.

This contract was completed during the year and final payment was made.

*Contract No. 69, Camden Iron Works. — Furnishing Cast-iron Pipes and Special Castings, Boston.*

On June 15, 1907, bids were received for cast-iron pipes and special castings, and on June 27 a contract was made with the Camden Iron Works.

*Contract No. 75, Westinghouse Traction Brake Company. —  
Furnishing Air Compressor Plant, Boston.*

On Aug. 30, 1907, a contract was made with the Westinghouse Traction Brake Company for constructing the air compressor plant needed for the Lock. The amount of the contract was \$1,393.20.

The work to be done consists in furnishing and delivering at the Lock the following equipment, complete and in good working order, with the necessary appurtenances:—

- 2 D-4-EG motor driven air compressors arranged for continuous operation, with water jackets on the air cylinders.
- 1 type "J" governor.
- 4 reservoirs, 24½ inches diameter, 72 inches long.
- 1 marbleized slate switchboard.

No material had been delivered at the end of the year and no payment had been made.

*Contract No. 76, Hiram W. Phillips. — Building an Inverted Siphon for the Cambridge Marginal Conduit, at Lechmere Canal, Cambridge.*

On Sept. 9, 1907, bids were received for building an inverted siphon for the Cambridge Marginal Conduit, at Lechmere Canal, and on Sept. 12, 1907, a contract was made with Hiram W. Phillips for the construction of the siphon. The amount of the contract was \$14,500.

At the end of the year the dredging had been done and some of the piles for supporting the pipes had been driven. The value of the work done, as shown by the November, 1907, estimate, was \$870.

*Contract No. 78, The Lockwood Manufacturing Company. — Constructing and erecting a Sluice-gate in the Cambridge Marginal Conduit, Cambridge.*

On Sept. 16, 1907, bids were opened for constructing a sluice-gate for the Cambridge Marginal Conduit, and on Sept. 19, 1907, a contract was made with The Lockwood Manufacturing Company for the gate. The amount of the contract was \$1,673.

The work to be done consisted in constructing and erecting a 4' 3" by 6' sluice-gate, with operating stand and appurtenances.

This gate had not been delivered at the end of the year and no payment had been made.

Respectfully submitted,

HIRAM A. MILLER,  
*Chief Engineer.*

Boston, March 17, 1908.





## APPENDIX A.

---

### CHAPTER 465 OF THE ACTS OF THE YEAR 1903.

#### AN ACT TO AUTHORIZE THE CONSTRUCTION OF A DAM ACROSS THE CHARLES RIVER BETWEEN THE CITIES OF BOSTON AND CAMBRIDGE.

*Be it enacted, etc., as follows:*

SECTION 1. The governor of the Commonwealth, with the advice and consent of the council, shall appoint three commissioners, residents of the metropolitan parks district, who shall constitute the Charles river basin commission, hereinafter called the commission, and who shall be sworn before entering upon the duties of their office. One commissioner shall be designated by the governor as chairman, and two commissioners shall constitute a quorum. The term of office shall be three years, and all vacancies shall be filled by the governor, with the advice and consent of the council. Any commissioner may be removed by the governor, with the advice and consent of the council, for such cause as he shall deem sufficient and shall assign in the order of removal. Each commissioner shall receive an annual salary of such amount as the governor and council shall determine.

Charles river  
basin commis-  
sion, appoint-  
ment, term,  
etc.

Compensation.

SECTION 2. The commission may appoint a secretary, engineers and assistants, shall keep accurate accounts of its expenditures, and shall make an annual report of its doings, including an abstract of its accounts, to the governor and council. The commission whenever the Commonwealth has been authorized by the United States to build a dam and lock under the provisions of this act, shall proceed to do the work herein required of it, and shall in the meantime make examinations and plans therefor.

Powers and  
duties.

*Section 3.  
Dam on the  
Charles river  
between Boston  
and Cambridge.*

**SECTION 3.** The commission shall construct across Charles river between the cities of Boston and Cambridge, a dam, at least sufficiently high to hold back all tides and to maintain in the basin above the dam a substantially permanent water level not less than eight feet above Boston base. The dam shall occupy substantially the site of the present Orange bridge, which shall be removed by the commission. The dam shall be not less than one hundred feet in width at said water level and a part thereof shall be a highway and the remainder shall be a highway, or a park or parkway, as the commission shall determine. The dam shall be furnished with a lock not less than three hundred and fifty feet in length between the gates, forty feet in width and thirteen feet in depth below Boston base, and shall be built with a suitable drawbridge or drawbridges, wasteways and other appliances. The part of the dam used as a highway shall be maintained and operated in the same manner as the Cambridge bridge, and under the laws now or hereafter in force relating to said bridge.

*Navigable  
channels to be  
dredged.*

**SECTION 4.** The commission shall dredge navigable channels in the basin from the lock to the wharves between the dam and Cambridge bridge, to Broad canal and to Lechmere canal, the channel to be not less than one hundred feet in width and eighteen feet in depth; shall dredge Broad canal to such depths as will afford to and at the wharves thereon not less than seventeen feet of water up to the Third Street draw, not less than thirteen feet of water from the Third Street draw to the Sixth Street draw, and not less than eleven feet of water from the Sixth Street draw to the railroad draw, and not less than nine feet of water for one hundred and twenty-five feet above the railroad draw; shall dredge Lechmere canal to such depths as will afford to and at the wharves thereon not less than seventeen feet of water up to and including Sawyer's lumber wharf, and not less than thirteen feet of water from said wharf up to the head of the canal at Bent street; all depths aforesaid to be measured from the water level to be maintained in the basin.

The commission shall do all such dredging and all strengthening of the walls of the canals and of the basin where dredging is done by the driving of prime oak piles two feet on centres along the front of said wharves or walls, and all removing and relocating of pipes and conduits made necessary by such dredging, so that vessels requiring a depth of water not exceeding the respective depths above prescribed can lie alongside of, and in contact with, the wharves; and this work shall be done in such manner as to cause the least possible inconvenience to abutters, and shall be finished on or before the completion of the dam; and after the walls or wharves have been so strengthened, all repairs on or rebuilding of the walls and wharves shall be done by the abutters.

Manner of  
dredging, etc.

The commission shall do such dredging in the basin outside of the channels aforesaid as may be necessary for the removal of sewage, sludge or any offensive deposit; shall do such other dredging as it shall deem proper, and shall take all proper measures for the destruction of malarial mosquitoes in the basin and its vicinity.

Certain other  
dredging to be  
done, etc.

SECTION 5. The commission, before the completion of the dam, shall construct marginal conduits on the north side of the basin from the outlet of the overflow channel in Binney street to a point below the dam, and on the south side of the basin from the present outlet of the Back Bay Fens to a point below the dam, and may construct an extension thereof toward, or to, St. Mary street, the conduits to be used to receive and conduct below the dam the overflow from sewers and the surface drainage and other refuse matter which would otherwise pass into the basin.

Marginal  
conduits to be  
constructed,  
etc.

SECTION 6. The commission, for the purpose of carrying out the provisions of the preceding sections, may from time to time take in fee or otherwise, by purchase or otherwise, for the Commonwealth, or the city of Boston or the city of Cambridge, as the commission shall determine, lands, flats and lands covered by tide-water on Charles river, by filing in the registry of deeds for the county and district in which the lands or flats are

Certain land  
etc., may be  
taken, etc.

situated a description thereof, sufficiently accurate for identification, signed by a majority of the commissioners; and any person whose property is so taken may have compensation therefor as determined by agreement with the commission, and if they cannot agree the compensation may be determined by a jury in the superior court for the county where the property is situated under the same provisions of law, so far as they are applicable, which apply in determining the value of lands taken for highways under chapter forty-eight of the Revised Laws, upon petition therefor by the commission, or by such person, filed in the clerk's office of said court against the Commonwealth or the city for which the lands or flats are taken within one year after the taking, and costs shall be taxed and execution issued as in civil cases.

The metro-  
politan park  
commissioner  
have exclusive  
control of  
dam, etc.

SECTION 7. The metropolitan park commission, when the work provided for in the preceding sections is finished, shall, subject to the powers vested by law in the state board of health, have exclusive control of the dam and lock and of the basin and river between the dam and the city of Waltham, as a part of the metropolitan parks system, and of all poles, wires and other structures placed or to be placed on, across, over or in any part of said basin, dam or lock, and of the placing thereof, except the part of the dam used as a highway and the bridges and other structures erected by any city or town within its limits and upon its own lands; may make reasonable rules and regulations, not impairing freight traffic, for the care, maintenance, protection and policing of the basin; and throughout the year shall operate the lock without charge, maintain the lock, channels and canals aforesaid at the depths aforesaid, and clear of obstructions caused by natural shoaling or incident to the building of the dam, and maintain the water in the basin at such level and the lock, channels and canals sufficiently clear of obstructions by ice so that any vessel ready to pass through the lock, and requiring no more depth of water than aforesaid, can pass through to the wharves aforesaid. In the event of an emergency,

May make  
rules and  
regulations,  
etc.



requiring the temporary reduction of such level, notice thereof shall be given to the occupants of said wharves, and such reduction shall not be lower nor continue longer than the emergency requires. Said metropolitan park commission may order the removal of all direct sewage or factory waste as a common nuisance from the river and its tributaries below the city of Waltham; and no sewer, drain, overflow or other outlet for factory or house drainage shall hereafter be connected with the basin below said city without the approval of the metropolitan park commission.

Notice to be given in case of emergency requiring temporary reduction of level, etc.

Removal of direct sewage or factory waste may be ordered, etc.

SECTION 8. The Commonwealth shall in the first instance pay all expenses incurred in carrying out the provisions of the preceding sections, and the same shall, except as provided in the following section, constitute part of the cost of construction and maintenance of the metropolitan parks system; and in addition to the amounts heretofore authorized for such construction the treasurer and receiver-general shall, from time to time, as authorized by the governor and council, issue notes, bonds or scrip, in the name and behalf of the Commonwealth, entitled Charles River Basin Loan, to the amount which the commission may deem necessary for the expenses incurred under the first six sections of this act; and all acts and parts of acts relative to loans for such construction and providing for their payment shall, so far as they may be applicable and not inconsistent herewith, apply to such notes, bonds and scrip, and to their payment.

Payment of expenses.

Charles River Basin Loan.

SECTION 9. The commissioners next appointed under the provisions of chapter four hundred and nineteen of the acts of the year eighteen hundred and ninety-nine, and amendments thereof, in apportioning the expenses of maintaining the metropolitan parks system shall include as part thereof the expense of maintenance incurred under the preceding sections of this act; shall also determine, as they shall deem just and equitable, what portion of the total amount expended for construction under sections three, four, five and six of this act shall be apportioned to the cities of Boston and Cam-

Apportionment of expenses, etc.



bridge as the cost of the removal of Craigie bridge and the construction of a suitable bridge in place thereof, and the remainder shall be considered and treated as part of the cost of construction of the metropolitan park system. The treasurer and receiver-general shall determine the payments to be made each year by said cities, one-half by each, to meet the interest and sinking fund requirements for the amounts apportioned to them as the cost of such bridge, and the same shall be paid by each city into the treasury of the Commonwealth as part of its state tax.

City of Boston  
to do certain  
dredging,  
construct con-  
duits, sewer,  
etc.

SECTION 10. The city of Boston, by such officer or officers as the mayor may designate, shall forthwith after the passage of this act, do such dredging in the Back Bay Fens as the board of health of said city may require, shall construct a conduit between Huntington avenue and Charles river, to form an outlet into Charles river for the commissioners' channel of Stony brook, shall reconstruct the present connections between the river and the Fens so as to allow free access of water from the river into the streams and ponds in the Fens and thence into the river, and shall construct a sewer in the rear of the houses on the north side of Beacon street between Otter and Hereford streets. Such officer or officers may construct a conduit between Green street and Forest Hills and may construct or rebuild within five years one or more conduits for Stony brook between the westerly side of Elmwood street and the Fens: *provided, however*, that the expense of such conduits between Green street and Forest Hills and between Elmwood street and the Fens shall be paid for out of the annual appropriation for sewer construction under the provisions of chapter four hundred and twenty-six of the acts of the year eighteen hundred and ninety-seven and acts in amendment thereof or in addition thereto.

Proviso.

Wall or em-  
bankment may  
be built on  
Boston side of  
Charles river.

SECTION 11. The board of park commissioners of Boston may, with the approval of the mayor, build a wall or embankment on the Boston side of Charles river beginning at a point in the southwest corner of the stone wall of the Charlesbank, thence running

southerly by a straight or curved line to a point in Charles river not more than three hundred feet distant westerly from the harbor commissioners' line, measuring on a line perpendicular to the said commissioners' line at its intersection with the southerly line of Mount Vernon street, but in no place more than three hundred feet westerly from said commissioners' line; thence continuing southerly and westerly by a curved line to a point one hundred feet or less from the wall in the rear of Beacon street; thence by a line substantially parallel with said wall to the easterly line of the Back Bay Fens, extended to intersect said parallel line.

SECTION 12. The board of park commissioners of said city may take, in fee or otherwise, by purchase or otherwise, for said city, for the purpose of a public park such lands, flats and lands covered by tide-water between Charles, Brimmer and Back streets and the line of the wall or embankment aforesaid, as the mayor shall approve, by filing in the registry of deeds for the county of Suffolk a description thereof sufficiently accurate for identification, signed by a majority of the commissioners, and shall construct a public park on the lands so taken; and any person whose property is so taken may have compensation therefor as determined by agreement with the board, and if they cannot agree the amount thereof may be determined by a jury in the superior court for the county of Suffolk, under the same provisions of law, so far as they may be applicable, which apply in determining the value of lands taken for highways under chapter forty-eight of the Revised Laws, upon petition therefor by the board, or by such person, filed in the clerk's office of said court against said city within one year after the taking, and costs shall be taxed and execution issued as in civil cases.

Certain lands, flats, etc., may be taken for a public park.

SECTION 13. The city of Boston shall pay the expenses incurred under sections ten, eleven and twelve of this act, except as otherwise provided in section ten of this act; and to meet said expenses the city treasurer of the city shall, from time to time, on the request of the mayor, issue and sell bonds of the city to an amount

City of Boston to pay certain expenses, etc.

City treasurer to issue bonds, etc.

not exceeding eight hundred thousand dollars, and the bonds so issued shall not be reckoned in determining the legal limit of indebtedness of the city.

The Boston  
and Maine  
Railroad to  
remove certain  
structures, etc.

SECTION 14. The lock shall be built above the lower line of the dam, and the Boston and Maine Railroad shall, before the dam is completed, remove its bridge, piles and any other structures in Charles River which are southerly or westerly of a line defined in red on a plan filed in the office of the board of harbor and land commissioners marked "Plan showing line from above or southwest of which the Boston & Maine Railroad shall remove all of its structures in Charles River and between the harbor lines, May 25, 1903. Woodward Emery, Chairman of Harbor and Land Commissioners"; and may rebuild the same northerly and easterly of the line so defined. The draw in the new bridge shall not be easterly of nor more than fifty feet westerly from the location of the present draw, and shall be so located as to be directly opposite the lock. Within the limits herein prescribed the commission shall determine the position of the lock and draw.

Enforcement  
of provisions  
of act, etc.

SECTION 15. The supreme judicial court and the superior court shall, upon application of any party in interest, including any owner or occupant of property abutting on the basin or on Broad canal or Lechmere canal, have jurisdiction to enforce, or prevent violation of, any provision of this act and any order, rule or regulation made under authority thereof.

Repeal.

SECTION 16. Chapter three hundred and forty-four of the acts of the year eighteen hundred and ninety-one, as amended by section one of chapter four hundred and thirty-five of the acts of the year eighteen hundred and ninety-three, and chapter five hundred and thirty-one of the acts of the year eighteen hundred and ninety-eight are hereby repealed.

When to take  
effect.

SECTION 17. This act shall take effect on the first day of July in the year nineteen hundred and three.  
[Approved June 24, 1903.]



## CHAPTER 107 OF THE RESOLVES OF THE YEAR 1904.

RESOLVE TO PROVIDE FOR THE ACCEPTANCE BY THE COMMONWEALTH OF THE CONDITIONS AND LIMITATIONS SET FORTH IN A CERTIFICATE OF THE ACTING SECRETARY OF WAR OF THE UNITED STATES RELATING TO THE CONSTRUCTION AND MAINTENANCE OF THE CHARLES RIVER DAM.

*Resolved*, That the express conditions and limitations set forth in a certificate of Robert Shaw Oliver, acting secretary of war, under date of the eighteenth day of May, nineteen hundred and four, relating to the construction and maintenance of a dam across the Charles river, and to the maintenance of channels in connection therewith, be, and hereby are, accepted, and the obligations thereof assumed by the Commonwealth, as follows:—

Construction of Charles river dam, etc., acceptance of certain conditions, etc.

1. That detailed plans for the lock and dam, and of all channels to be dredged outside established harbor lines, shall be submitted to the secretary of war, and that the work be not begun until such plans have received his approval.

2. That the Charles River basin commission, or its successors, shall operate the lock, at their own expense, as a free navigable waterway of the United States, subject to such regulations as the secretary of war may promulgate.

3. That the emptying of the basin shall be subject to regulation by the secretary of war.

4. That the Charles River basin commission shall dredge and maintain in the basin, from the head of the lock to the channel in the river, a channel one hundred feet wide and eighteen feet deep at mean low water, in a location to be approved by the secretary of war.

5. That, whenever called upon to do so by the secretary of war, the Charles River basin commission shall deepen two and two tenths feet the channel eighty feet wide called for by the present approved project for the improvement of Charles river by the United States,

known as the project of June fourteen, eighteen hundred and eighty, the said deepening to extend as far as Brackett's wharf.

6. That the Commonwealth of Massachusetts shall maintain in the Charles river from the head of the thirty-five foot channel at Charles river bridge to the dam and lock, the necessary depth and width of channel for the commerce of the river, as fixed by the secretary of war.

7. That the alterations in the bridge of the Boston and Maine Railroad ordered by said act of the general court of Massachusetts shall be made, approval of the plans by the secretary of war being obtained, as required by law.

8. That the approval hereby granted shall not be construed as authorizing any invasion of property rights, or any act whereby a claim for damages against the United States might arise. [*Approved June 3, 1904.*]

CHAPTER 65 OF THE ACTS OF THE YEAR 1906.

**AN ACT TO AUTHORIZE THE CHARLES RIVER BASIN COMMISSION TO CONSTRUCT A TEMPORARY HIGHWAY BRIDGE OVER THE CHARLES RIVER.**

*Be it enacted, etc., as follows:*

1906, 405, § 2,  
amended.

SECTION 1. Section three of chapter four hundred and sixty-five of the acts of the year nineteen hundred and three is hereby amended by inserting after the word "commission", in the eighth line, the words:— The commission may construct or otherwise provide a temporary highway bridge and approaches thereto for the use of vehicles and pedestrians during the construction of the dam,— so as to read as follows:— *Section 3.* The commission shall construct across Charles river between the cities of Boston and Cambridge, a dam, at least sufficiently high to hold back all tides and to maintain in the basin above the dam a substantially permanent water level not less than eight feet above Boston base. The dam shall occupy substantially the site of

Dam to be constructed across Charles river, etc.



the present Craigie bridge, which shall be removed by the commission. The commission may construct or otherwise provide a temporary highway bridge and approaches thereto for the use of vehicles and pedestrians during the construction of the dam. The dam shall be not less than one hundred feet in width at said water level and a part thereof shall be a highway and the remainder shall be a highway, or a park or parkway, as the commission shall determine. The dam shall be furnished with a lock not less than three hundred and fifty feet in length between the gates, forty feet in width and thirteen feet in depth below Boston base, and shall be built with a suitable drawbridge or drawbridges, waste-ways and other appliances. The part of the dam used as a highway shall be maintained and operated in the same manner as the Cambridge bridge, and under the laws now or hereafter in force relating to said bridge.

SECTION 2. This act shall take effect upon its passage. [*Approved February 9, 1905.*]

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CHAPTER 158 OF THE ACTS OF THE YEAR 1906.

AN ACT TO PROHIBIT THE POLLUTION OF THE CHARLES RIVER WITHIN THE METROPOLITAN PARKS DISTRICT.

*Be it enacted, etc., as follows:*

SECTION 1. The state board of health is hereby authorized, upon the petition of the metropolitan park commission, or the mayor of any city or the selectmen of any town within the metropolitan parks district, and after notice to all parties interested and a hearing, to prohibit the entrance or discharge of sewage into that part of the Charles river within the present boundaries of said metropolitan parks district, and to prevent the entrance or discharge of every other substance, except surface or storm water, into said river within said parks district which may be injurious to public health, or may tend to create a public nuisance, or to obstruct the flow of water within said parks district, including all waste

The state board of health may prohibit the discharge of sewage into Charles river, etc.

or refuse from any factory or other establishment where persons are employed, unless the owner thereof shall use the best practicable and reasonably available means to render such waste or refuse harmless.

*Jurisdiction.*

SECTION 2. The supreme judicial court or any justice thereof and the superior court or any justice thereof shall have jurisdiction in equity to enforce the provisions of this act and any order made by the state board of health in conformity therewith. Proceedings to enforce any such order shall be instituted and prosecuted by the attorney-general upon the request of the state board of health.

SECTION 3. This act shall take effect upon its passage. [*Approved March 14, 1906.*]

CHAPTER 368 OF THE ACTS OF THE YEAR 1906.

AN ACT RELATIVE TO THE TRANSFER OF THE CARE AND CONTROL OF THE CHARLES RIVER DAM AND BASIN TO THE METROPOLITAN PARK COMMISSION.

*Be it enacted, etc., as follows:*

1906, 466, § 3,  
amended.

SECTION 1. Section three of chapter four hundred and sixty-five of the acts of the year nineteen hundred and three is hereby amended by striking out the last sentence thereof, so as to read as follows: — *Section 3.*

Dam to be constructed across  
Charles river.

The commission shall construct across Charles river between the cities of Boston and Cambridge, a dam, at least sufficiently high to hold back all tides and to maintain in the basin above the dam a substantially permanent water level not less than eight feet above Boston base. The dam shall occupy substantially the site of the present Craigie bridge, which shall be removed by the commission. The dam shall be not less than one hundred feet in width at said water level and a part thereof shall be a highway and the remainder shall be a highway, or a park or parkway, as the commission shall determine. The dam shall be furnished with a lock not less than three hundred and fifty feet in length between the gates, forty feet in width and thirteen feet

in depth below Boston base, and shall be built with a suitable drawbridge or drawbridges, wasteways and other appliances.

SECTION 2. Section seven of said chapter four hundred and sixty-five is hereby amended by inserting after the word "exclusive", in the fourth line, the words:—care and,—by inserting after the word "lock", in the fifth line, the words:—and of any highway, park or parkway, drawbridge or drawbridges, constructed in connection therewith,—by inserting after the word "lock", in the ninth line, the words:—highway, park or parkway, drawbridge or drawbridges,—by striking out the words "the part of the dam used as a highway and", in the tenth line, by striking out the word "the", before the word "basin", in the fourteenth line, and inserting in place thereof the word:—said,—by inserting after the word "basin", in the fourteenth line, the words:—dam, lock, highway, park, parkway, drawbridge or drawbridges, breaches of which rules shall be breaches of the peace, punishable as such,—by inserting after the word "lock", in the fifteenth line, the words:—and drawbridge or drawbridges,—and by adding at the end thereof the words:—Said metropolitan park commission shall also have and exercise over said basin, dam, lock, highway, park, parkway, drawbridge or drawbridges, all other power, duties and liabilities now imposed upon said commission by chapter four hundred and seven of the acts of the year eighteen hundred and ninety-three and acts in addition thereto and in amendment thereof relative to the care, maintenance and control by said commission of open spaces for exercise and recreation so far as the provisions of said acts are consistent with the provisions of this act,—so as to read as follows:—*Section 7.* The metropolitan park commission, when the work provided for in the preceding sections is finished, shall, subject to the powers vested by law in the state board of health, have exclusive care and control of the dam and lock and of any highway, park or parkway, drawbridge or drawbridges, con-

1903, 465, § 7.  
amended.

The metro-  
politan park  
commission to  
have care of  
dam, etc.



structed in connection therewith and of the basin and river between the dam and the city of Waltham, as a part of the metropolitan parks system, and of all poles, wires and other structures placed or to be placed on, across, over or in any part of said basin, dam or lock, highway, park or parkway, drawbridge or drawbridges, and of the placing thereof, except the bridges and other structures erected by any city or town within its limits and upon its own lands; may make reasonable rules and regulations, not impairing freight traffic, for the care, maintenance, protection and policing of said basin, dam, lock, highway, park, parkway, drawbridge or drawbridges, breaches of which rules shall be breaches of the peace, punishable as such; and throughout the year shall operate the lock and drawbridge or drawbridges without charge, maintain the lock, channels and canals aforesaid at the depths aforesaid, and clear of obstructions caused by natural shoaling or incident to the building of the dam, and maintain the water in the basin at such level and the lock, channels and canals sufficiently clear of obstructions by ice so that any vessel ready to pass through the lock, and requiring no more depth of water than aforesaid, can pass through to the wharves aforesaid. In the event of an emergency, requiring the temporary reduction of such level, notice thereof shall be given to the occupants of said wharves, and such reduction shall not be lower nor continue longer than the emergency requires. Said metropolitan park commission may order the removal of all direct sewage or factory waste as a common nuisance from the river and its tributaries below the city of Waltham; and no sewer, drain, overflow or other outlet for factory or house drainage shall hereafter be connected with the basin below said city without the approval of the metropolitan park commission. Said metropolitan park commission shall also have and exercise over said basin, dam, lock, highway, park, parkway, drawbridge or drawbridges, all other power, duties and liabilities now imposed upon said commission by chapter four hundred and seven of

the acts of the year eighteen hundred and ninety-three and acts in addition thereto and in amendment thereof relative to the care, maintenance and control by said commission of open spaces for exercise and recreation so far as the provisions of said acts are consistent with the provisions of this act.

SECTION 3. When the work of the Charles river basin commission as provided for in said chapter four hundred and sixty-five is finished, said commission shall certify the fact in writing to the metropolitan park commission, and such certificate or a copy of the same, attested by any member of the metropolitan park commission or by its secretary, shall be prima facie evidence that the exclusive care and control of said dam, lock, highway, park or parkway, drawbridge or drawbridges, are vested in the metropolitan park commission.

When dam is completed the Charles river basin commission to certify the same, etc.

SECTION 4. So much of chapter four hundred and sixty-seven of the acts of the year eighteen hundred and ninety-eight as is inconsistent herewith is hereby repealed.

Repeal.

SECTION 5. This act shall take effect upon its passage. [*Approved May 8, 1906.*]

#### CHAPTER 402 OF THE ACTS OF THE YEAR 1906.

#### AN ACT RELATIVE TO THE CHARLES RIVER BASIN.

*Be it enacted, etc., as follows:*

SECTION 1. Section eight of chapter four hundred and sixty-five of the acts of the year nineteen hundred and three is hereby amended by striking out the words "the preceding", in the third line, by inserting after the word "sections", in the same line, the words: — one, two, three, four, five, six, seven, eleven and twelve, as amended, — and by striking out the words "the first six sections", in the thirteenth line, and inserting in place thereof the words: — sections one, two, three, four, five, six, eleven and twelve, — so as to read as follows: — *Section 8.* The Commonwealth shall in the first instance pay all expenses incurred in carrying out the

1903, 485, § 8, amended.

Payment of expenses.



provisions of sections one, two, three, four, five, six, seven, eleven and twelve, as amended, and the same shall, except as provided in the following section, constitute part of the cost of construction and maintenance of the metropolitan parks system; and in addition to the amounts heretofore authorized for such construction the treasurer and receiver general shall, from time to time, as authorized by the governor and council, issue notes, bonds or scrip, in the name and behalf of the Commonwealth, entitled Charles River Basin Loan, to the amount which the commission may deem necessary for the expenses incurred under sections one, two, three, four, five, six, eleven and twelve of this act; and all acts and parts of acts relative to loans for such construction and providing for their payment shall, so far as they may be applicable and not inconsistent herewith, apply to such notes, bonds and scrip, and to their payment.

1903, 465, § 9,  
amended.

Apportion-  
ment of ex-  
penses.

SECTION 2. Said chapter four hundred and sixty-five is hereby further amended by striking out section nine and inserting in place thereof the following:—*Section 9.* The commissioners appointed under the provisions of chapter four hundred and nineteen of the acts of the year eighteen hundred and ninety-nine, and amendments thereof, in apportioning the expenses of maintaining the metropolitan parks system shall include as part thereof the expense of maintenance incurred under sections one, two, three, four, five, six, seven, eight, eleven and twelve of this act; shall also determine as they shall deem just and equitable what portion of the total amount expended for construction under sections three, four, five and six of this act shall be apportioned to the cities of Boston and Cambridge as the cost of the removal of Craigie bridge and the construction of a suitable bridge in place thereof, and the remainder shall be considered and treated as part of the cost of construction of the metropolitan park system; and shall also determine as they shall deem just and equitable, what portion of the total amount expended for the cost of construction of the marginal

conduit on the south side of the basin and of the embankment and park, provided for by this act, shall be apportioned to the city of Boston as the cost of the construction of said embankment and park, and what portion shall be fixed as the cost of said marginal conduit. The cost of the construction of said embankment and park, as so apportioned shall be repaid to the Commonwealth by the city of Boston with four per cent interest from the date of said apportionment, and bills for the betterments assessed by the Charles River Basin commission under the provisions of this act shall be listed and committed to the collector of taxes of the city of Boston, and shall be collected under the same provisions of law as betterments levied for the construction of highways in the city of Boston. All amounts so received by the city of Boston from said betterments shall be applied first toward paying to the Commonwealth said apportionment for the cost of construction of said embankment and park as above provided; and second to the interest and sinking fund requirements of the loan of the city of Boston authorized by this act. The treasurer and receiver general shall determine the payments to be made each year by the cities of Boston and Cambridge, one half by each, to meet the interest and sinking fund requirements for the amounts apportioned to them as the cost of such bridge, and the same shall be paid by each city into the treasury of the Commonwealth as a part of its state taxes. The city treasurer of Boston shall from time to time on the request of the mayor issue and sell bonds of the city to meet the payments to the Commonwealth required by this section, and the bonds so issued shall not be reckoned in determining the statutory limit of indebtedness of the city.

SECTION 3. Said chapter four hundred and sixty-five is hereby further amended by striking out section eleven and inserting in place thereof the following:—

*Section 11.* The Charles River Basin commission shall build a wall and embankment on the Boston side of Charles river, beginning at a point in the southwest

1903, 465, § 11,  
amended.

Wall and embankment may be built on Boston side of Charles river.

corner of the stone wall of the Charlesbank, thence running southerly by a straight or curved line to a point in Charles river not more than three hundred feet westerly from the harbor commissioners' line, measuring on a line perpendicular to the said commissioner's line at its intersection with the southerly line of Mount Vernon street, but in no place more than three hundred feet westerly from the said commissioners' line thence continuing southerly and westerly by a curve line to a point one hundred feet or less from the wall in the rear of Beacon street; thence by a line substantially parallel with said wall, but at no point more than one hundred feet distant therefrom, to the westerly line of the Back Bay Fens extended to intersect said parallel line.

1903, 465, § 12,  
amended.

Certain lands,  
etc., may be  
taken for a  
public park.

Proviso.

SECTION 4. Said chapter four hundred and sixty five is hereby further amended by striking out section twelve and inserting in place thereof the following:—

*Section 12.* The Charles River Basin commission shall acquire in fee, or otherwise, by purchase or otherwise for the city of Boston, for the purpose of a public park parkway or street, flats and lands covered by tide water and lying easterly of Charlesgate West by filing in the registry of deeds for the county of Suffolk a description thereof sufficiently accurate for identification, signed by a majority of said commission, and shall construct a public park or lay out a parkway or street, on the lands so taken: *provided, however,* that nothing herein contained shall authorize the taking for any purpose of Back street, or of any lot or part of any lot on the north side of Beacon street or of any flats or land covered by tide water south of West Boston bridge and lying between the line of the wall the construction whereof is provided for in section eleven of this act and the Cambridge shore, nor the taking for any purpose but that of a public park of any flats or land covered by tide water between said wall and the sea wall at present existing; and any person whose property is so taken may have compensation therefor as determined



by agreement with the commission, or, in the absence of such agreement, the amount thereof may be determined by a jury in the superior court for the county of Suffolk upon petition therefor by the commissioners or by such person, filed in the clerk's office of said court, against the Commonwealth, and within one year after the taking, and under the same proceedings and provisions of law, so far as they may be applicable, which apply in determining the value of lands taken for highways under chapter forty-eight of the Revised Laws. And because of the construction and maintenance of the embankment and park as herein provided and the establishment of the northerly line thereof as herein finally fixed and defined as the limit of any embankment or construction northerly from Beacon street between the Charlesbank and the Back Bay Fens, said commission shall within two years after the completion of the park as herein provided and defined determine the value of the benefit or advantage, from the establishment of said embankment and park, beyond that resulting to all real estate in the city of Boston, to each parcel of real estate east of the Back Bay Fens bordering upon or near said embankment and park as so completed, and shall assess such betterment upon the said estates so benefited; but such assessments shall in no event exceed in the aggregate one half of the actual cost of construction of said embankment and park, exclusive of the cost of the marginal conduit, nor the sum of thirty dollars for each lineal front foot of private ownership. Any person aggrieved by such assessment of betterments may within one year thereafter file a petition in the superior court for the county of Suffolk, and after notice to the city of Boston shall have a trial by jury therein, and costs shall be awarded as provided in section seven of chapter fifty of the Revised Laws.

SECTION 5. Section thirteen of said chapter four hundred and sixty-five is hereby amended by striking out the words "sections ten, eleven and twelve", in the second line, and inserting in place thereof the words: —

1903, 465, § 13,  
amended.

City of Boston  
to pay certain  
expenses.

section ten, — and by striking out the words “section ten of this act”, in the third and fourth lines, and inserting in place thereof the words: — said section ten, — so as to read as follows: — *Section 13.* The city of Boston shall pay the expenses incurred under section ten of this act, except as otherwise provided in said section ten; and to meet said expenses the city treasurer of the city shall, from time to time, on the request of the mayor, issue and sell bonds of the city to an amount not exceeding eight hundred thousand dollars, and the bonds so issued shall not be reckoned in determining the legal limit of indebtedness of the city.

Repeal.

SECTION 6. Chapter three hundred and forty-four of the acts of the year eighteen hundred and ninety-one and chapter four hundred and thirty-five of the acts of the year eighteen hundred and ninety-three are hereby repealed.

SECTION 7. This act shall take effect upon its passage. [*Approved May 21, 1906.*]

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CHAPTER 404 OF THE ACTS OF THE YEAR 1907.

**AN ACT TO AUTHORIZE THE METROPOLITAN PARK COMMISSION JOINTLY WITH THE CHARLES RIVER BASIN COMMISSION TO GRANT LOCATIONS FOR BOAT HOUSES.**

*Be it enacted, etc., as follows:*

Locations of  
boat houses on  
Charles river.

SECTION 1. The Charles river basin commission shall make provision in the construction and laying out of the park or parkway provided for by chapter four hundred and two of the acts of the year nineteen hundred and six, for the location of boat houses, landings thereon and floats in connection therewith. At any time after the passage of this act, upon the petition of any duly organized boat club for a location for a boat house, landing or floats in connection therewith, said commission and the metropolitan park commission by a majority of the members of both commissions acting jointly as one board for the purpose, and, after the



completion by said Charles river basin commission of the work imposed upon it by law, the metropolitan park commission alone, may grant to such boat club a suitable location, by lease or otherwise, with the right to erect a boat house thereon and to project landings and floats on the waters of the Charles river contiguous thereto, upon such terms, conditions, restrictions and agreements and for such period of years, not exceeding twenty-five, as said commissions acting jointly, or, after the completion of said work, as the metropolitan park commission may deem expedient. In passing upon such petition consideration shall be given to the fact that at the time of the passage of this act such boat club owned or occupied a boat house on the southerly or easterly side of the Charles river between Charlesgate west and the new dam, the point on the river bank at which such boat house was situated and the length of time during which it had been owned or maintained there.

SECTION 2. This act shall take effect upon its passage. [*Approved May 13, 1907.*]

## APPENDIX B.

## CONTRACTS MADE AND PENDING

1. No. of Contract.	2.  WORK.	3. No. of Bids.	AMOUNT OF BID.		6.  Contractor.	
			4. Next to Lowest.	5. Lowest.		
1	1	Dam and Lock in the Charles River.	11	\$801,007 50 <sup>1</sup>	\$761,900 00	Heilbrook, Cabot & Rollins Corporation.
2	2 <sup>2</sup>	Wooden block paving for temporary bridge.	- <sup>3</sup>	- <sup>3</sup>	11,700 00 <sup>1</sup>	United States Wood Preserving Company.
3	5	Pumps, . . . . .	2	9,533 00 <sup>1</sup>	7,423 00	Henry R. Worthington.
4	19	Plans, specifications, engineering and patent rights for superstructure, operating machinery, etc., for drawbridge over Lock.	- <sup>3</sup>	- <sup>3</sup>	4,500 00 <sup>1</sup>	The Scherzer Rolling Lift Bridge Company.
5	23	Piles along walls of canals and Basin.	- <sup>3</sup>	- <sup>3</sup>	55,117 26 <sup>1</sup>	Heilbrook, Cabot & Rollins Corporation.
6	24	Scherzer rolling lift bridge.	7	41,562 00	40,800 00 <sup>1</sup>	American Bridge Company of New York.
7	25	Sluice-gates at the sluices in the Dam.	2 <sup>4</sup>	27,993 00	24,800 00 <sup>1</sup>	Coffin Valve Company.
8	27	Sluice-gates on the lock-gates in the Lock.	- <sup>3</sup>	- <sup>3</sup>	17,093 00 <sup>1</sup>	Coffin Valve Company.
9	28	Tide-gates at the Dam and Lock.	2	4,907 00	4,438 00 <sup>1</sup>	Coffin Valve Company.
10	30	Lock-gates, . . . . .	4	30,975 00	26,784 00 <sup>1</sup>	New Jersey-West Virginia Bridge Company.
11	32 <sup>2</sup>	Spruce lumber for repairing temporary bridge.	4	2,600 00	2,440 00 <sup>1</sup>	George W. Gale Lumber Company.
12	33 <sup>2</sup>	Castings and other metal.	2	3,285 63	2,025 10 <sup>1</sup>	Chelmsford Foundry Company.
13	34	White oak lumber for Lock.	1	-	646 43 <sup>1</sup>	George McQuesten Company.
14	35 <sup>2</sup>	Castings and other metal.	1	-	3,322 00 <sup>1</sup>	Gibby Foundry Company.
15	37	Electric dock capstans at Lock.	2 <sup>5</sup>	2,100 00 <sup>1</sup>	1,676 00	American Ship Windlass Company.
16	38 <sup>2</sup>	Motors for operating lock-gates.	2	2,700 00	2,635 40 <sup>1</sup>	Westinghouse Electric and Manufacturing Company.

<sup>1</sup> Contract based upon this bid.<sup>2</sup> Contract completed.<sup>3</sup> Competitive bids were not received on this contract.

## APPENDIX B.

DURING THE YEAR ENDING NOV. 30, 1907.

7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Nov. 30, 1907.	
Jan. 14, '06,	July 15, '08,	-	- -	\$860,000 00	\$541,978 53	1
Mar. 23, '06,	May 12, '05,	Apr. 26, '07,	- -	5,532 52	5,532 52	2
Sept. 30, '05,	-	-	- -	9,533 00	7,626 40	3
Aug. 25, '05,	-	-	- -	4,500 00	3,500 00	4
Dec. 4, '05,	-	-	- -	72,360 00	68,552 93	5
Mar. 16, '06,	-	-	- -	40,800 00	29,750 00	6
Mar. 16, '06,	-	-	- -	24,800 00	15,900 00	7
Mar. 6, '06,	-	-	- -	17,098 00	4,357 50	8
Mar. 16, '06,	-	-	- -	4,438 00	3,772 30	9
June 13, '06,	-	-	- -	26,784 00	15,300 00	10
Apr. 4, '06,	Jan. 1, '07,	Jan. 17, '07,	- -	3,699 14	3,699 14	11
May 23, '06,	July 22, '06,	July 30, '07,	- -	1,928 71	1,928 71	12
Apr. 11, '06,	-	-	- -	646 43	54 15	13
May 29, '06,	July 28, '06,	Dec. 26, '06,	- -	3,295 65	3,295 65	14
May 24, '06,	-	-	- -	2,100 00	1,575 00	15
May 25, '06,	-	Feb. 5, '07,	- -	2,635 40	2,635 40	16

4 Bids were based on different plans and specifications.

5 Bids were upon different types of capstans.

## CONTRACTS MADE AND PENDING DURING

1. No. of Contract.	2.  WORK.	3. No. of Bids.	AMOUNT OF BID.		6.  Contractor.
			4. Next to Lowest.	5. Lowest.	
1	40 <sup>1</sup> Plug drain valves, .	2	\$1,096 00	\$867 71 <sup>2</sup>	Chapman Valve Manufacturing Company.
2	41 Sluice-gates at the sluices and Boston Marginal Conduit.	- <sup>3</sup>	- <sup>3</sup>	11,802 00 <sup>2</sup>	Coffin Valve Company.
3	43 <sup>1</sup> Manganese bronze studs and bolts.	- <sup>2</sup>	- <sup>2</sup>	770 00 <sup>2</sup>	The William Cramp & Sons Ship & Engine Building Company.
4	44 Section 3 of the Boston Marginal Conduit and Section 1 of the Boston Embankment.	7	241,845 00	232,700 00 <sup>2</sup>	Coleman Brothers.
5	45 <sup>1</sup> Small boat lock-gates, .	4	1,337 50	850 00 <sup>2</sup>	Richard F. Keough.
6	46 <sup>1</sup> Structural steel, . .	3	7,380 00 <sup>2</sup>	7,200 00 <sup>4</sup>	New England Structural Company.
7	47 <sup>1</sup> Yellow pine timber for Lock stop-planks.	2	703 20	742 00 <sup>2</sup>	George McQuesten Company.
8	48 Steam, water and air piping.	9	2,158 00	2,098 00 <sup>2</sup>	The Lunaden & Van Stone Company.
9	49 <sup>1</sup> Small boat lock-gate hinges.	- <sup>3</sup>	- <sup>3</sup>	1,200 00 <sup>2</sup>	The William Cramp & Sons Ship & Engine Building Company.
10	50 Sections 4 and 5 of the Boston Marginal Conduit and Sections 2 and 3 of the Boston Embankment.	5	200,890 00 <sup>2</sup>	198,890 00 <sup>2, 5</sup>	Holbrook, Cabot & Rollins Corporation.
11	51 Boiler plant, . . .	6	2,068 00	2,030 00	Lynch & Woodward, Boston, Mass.
12	52 <sup>1</sup> Twisted steel rods for reinforcing concrete.	4	1,726 07	1,706 23 <sup>2</sup>	Aberthaw Construction Company.
13	53 <sup>1</sup> Gratings and ladders, .	3	1,525 00	1,223 00 <sup>2</sup>	L. M. Ham & Company, Boston, Mass.
14	54 <sup>1</sup> Plug drain valves, .	2	923 40	419 00 <sup>2</sup>	Coldwell-Wilcox Company, Newburgh, N. Y.
15	55 <sup>1</sup> Castings, . . .	2	726 25	515 00 <sup>2</sup>	Gibby Foundry Company.
16	56 <sup>1</sup> Cast-iron troughs, .	1	-	6,000 00 <sup>2</sup>	Camden Iron Works, Philadelphia, Pa.
17	57 Spruce lumber for repairing temporary bridge.	4	3,320 00	3,150 00 <sup>2</sup>	William H. Wood & Company, Cambridge, Mass.
18	58 <sup>1</sup> Lowering the Commercial Avenue sewer siphon, under Lechmere Canal.	3	4,500 00	3,150 00 <sup>2, 6</sup>	Hiram W. Phillips, Quincy, Mass.

<sup>1</sup> Contract completed.<sup>2</sup> Contract based upon this bid.<sup>3</sup> Competitive bids were not received on this contract.

# APPENDIX B.

79

YEAR ENDING NOV. 30, 1907 — *Continued.*

7. No. of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Nov. 30, 1907.	
7, '06,	Aug. 6, '06,	Oct. 31, '06,	- -	\$850 54	\$850 54	1
14, '06,	-	-	- -	11,862 00	6,755 25	2
15, '06,	July 15, '06,	Nov. 21, '06,	- -	770 09	770 09	3
24, '06,	Jan. 1, '08,	-	- -	310,000 00	167,828 84	4
17, '06,	-	Jan. 18, '07,	- -	850 00	850 00	5
19, '06,	Dec. 18, '06,	Mar. 16, '07,	- -	7,380 00	7,380 00	6
18, '06,	Nov. 12, '06,	Jan. 31, '07,	- -	790 72	790 72	7
20, '06,	-	-	- -	2,038 00	629 40	8
24, '06,	Nov. 1, '06,	Nov. 19, '06,	- -	1,260 00	1,260 00	9
5, '06,	Jan. 1, '06,	-	- -	430,000 00	70,066 09	10
4, '06,	-	-	For the whole work, \$2,164.	2,164 00	541 00	11
17, '06,	Feb. 1, '07,	Jan. 10, '07,	- -	1,767 79	1,767 79	12
24, '06,	Feb. 7, '07,	Mar. 16, '07,	For the whole work, \$1,223.	1,223 00	1,223 00	13
13, '06,	Mar. 13, '07,	Mar. 16, '07,	For the whole work, \$419.	419 00	419 00	14
15, '07,	Apr. 15, '07,	July 22, '07,	For iron castings, \$0.045 and \$0.035 per lb.	571 01	571 01	15
8, '07,	Apr. 23, '07,	June 15, '07,	For the whole work, \$6,060.	6,060 00	6,060 00	16
4, '07,	Jan. 1, '08,	-	For 2-inch and 3-inch spruce plank, \$21 per M. ft. B. M.	3,150 00	2,762 70	17
13, '07,	Apr. 1, '07,	May 10, '07,	For the whole work, \$3,150 plus the ad- ditional cost (not to exceed \$600) in- curred by encoun- tering quicksand.	3,931 34	3,931 34	18

It did not comply with requirements of specifications.

Its bid was on Section 4 of the Boston Marginal Conduit and Section 2 of the Boston Em-  
ent.

the additional cost (not to exceed \$600) incurred by encountering quicksand.



## CONTRACTS MADE AND PENDING DURING

1. No. of Contract.	2. WORK.	3. No. of Bids.	AMOUNT OF BID.		6. Contractor.
			4. Next to Lowest.	5. Lowest.	
1	59 Timber ice-run sluice-gate.	1	-	\$847 00 <sup>1</sup>	The Lockwood Manufacturing Company, East Boston, Mass.
2	60 Lock-gate operating machinery.	4	\$10,000 00 <sup>1</sup>	9,408 00 <sup>2</sup>	Link-Belt Company Chicago, Ill.
3	61 <sup>3</sup> Gratings, ladders and covers.	3	1,385 00	1,306 00 <sup>1</sup>	Fred A. Houdlette & Son, Boston, Mass.
4	62 <sup>2</sup> Twisted steel rods for reinforcing concrete.	2	2,373 75 <sup>1</sup>	1,997 18 <sup>2</sup>	Aberthaw Construction Company.
5	63 Lock-gate operating chain supports.	1	-	4,543 00 <sup>1</sup>	Baltimore Bridge Company, Baltimore, Md.
6	64 <sup>2</sup> Castings, . . .	2	5,450 00	4,871 00 <sup>1</sup>	Gibby Foundry Company.
7	65 <sup>2</sup> Cast-iron trough, . .	-4	-4	675 00 <sup>1</sup>	R. D. Wood & Company, Philadelphia, Pa.
8	66 Controlling devices for operating motors of main lock-gates.	-4	-4	2,908 00 <sup>1</sup>	The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.
9	67 <sup>2</sup> Twisted steel rods for reinforcing concrete.	5	2,051 54	1,922 43 <sup>1</sup>	H. P. Converse & Company, Boston, Mass.
10	68 <sup>2</sup> Yellow pine lumber for stop-planks.	3	951 83	928 61 <sup>1</sup>	George McQuesten Company.
11	69 Cast-iron pipes and special castings.	3	5,076 90	4,700 45 <sup>1</sup>	Camden Iron Works.
12	70 Main portion of the Cambridge Marginal Conduit.	5	59,835 00	55,320 00 <sup>1</sup>	Patrick McGovern, Boston, Mass.
13	71 Tide-gates for Boston Marginal Conduit.	-4	-4	1,899 30 <sup>1</sup>	Dodd & McLaughlin, Boston, Mass.

<sup>1</sup> Contract based upon this bid.<sup>2</sup> Bid did not comply with requirements of specifications.

# APPENDIX B.

81

AR ENDING Nov. 30, 1907 — *Continued.*

	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Nov. 30, 1907.	
07,	Feb. 24, '08,	-	For the whole work, \$847.	\$847 00	\$431 97	1
07,	Aug. 1, '07,	-	For the whole work, \$10,000.	10,000 00	-	2
07,	Aug. 12, '07,	Sept. 16, '07,	For the whole work, \$1,306.	1,306 00	1,306 00	3
07,	July 1, '07,	June 29, '07,	For square twisted steel rods, \$2.44 and \$2.64 per hundred lbs.	2,375 17	2,375 17	4
07,	July 9, '07,	-	For the whole work, \$4,543.	5,143 00	4,371 55	5
07,	Apr. 21, '07,	May 2, '07,	For the whole work, \$4,871.	4,871 00	4,871 00	6
07,	Apr. 23, '07,	May 24, '07,	For the whole work, \$675.	675 00	675 00	7
07,	Oct. 15, '07,	-	For the whole work, \$2,958.	2,958 00	-	8
07,	Sept. 1, '07,	July 30, '07,	For square twisted steel rods, \$1.9875 and \$2.1125 per hundred lbs.	2,155 56	2,155 56	9
07,	July 30, '07,	Sept. 18, '07,	For yellow pine lumber, \$40 per M. ft. B. M.	982 40	982 40	10
07,	Aug. 27, '07,	-	For 48-inch cast-iron pipe, \$29.35 per ton of 2,000 lbs.; 48-inch 1/16 curves, \$80 per ton of 2,000 lbs.	4,700 45	4,168 26	11
07,	May 1, '08,	-	For earth excavation and refill, \$11 per lin. ft. of trench; piles, \$0.20 per lin. ft.; underdrains, \$0.65 per lin. ft.; concrete masonry, \$9 and \$4.50 per cu. yd.; sheeting, \$35 per M. ft. B. M.; placing iron and other metal work, \$20 per ton of 2,000 lbs.; spruce lumber, \$40 per M. ft. B. M.	55,320 00	2,275 91	12
07,	-	-	For the whole work, \$1,869.30.	1,869 30	-	13

<sup>3</sup> Contract completed.

<sup>4</sup> Competitive bids were not received on this contract.

## CONTRACTS MADE AND PENDING DURING

1. No. of Contract.	2. WORK.	3. No. of Bids.	AMOUNT OF BID.		6. Contractor.
			4. Next to Lowest.	5. Lowest.	
1	72 Sidewalk lights at the sluices.	1	-	\$1,350 00 <sup>1</sup>	American Luxfer Prism Company of Illinois, Chicago, Ill.
2	73 <sup>2</sup> Twisted steel rods for reinforcing concrete.	5	\$1,055 92	1,016 37 <sup>1</sup>	H. P. Converse & Company.
3	74 2-inch pump at Lock, .	2 <sup>3</sup>	600 00	495 00 <sup>1</sup>	The Lawrence Machine Company, Lawrence, Mass.
4	75 Air compressor plant, .	4 <sup>4</sup>	1,393 20 <sup>1</sup>	1,025 00	Westinghouse Traction Brake Company, Pittsburgh, Pa.
5	76 Inverted siphon for the Cambridge Marginal Conduit, at Lechmere Canal.	1	-	14,500 00 <sup>1</sup>	Hiram W. Phillips.
6	77 <sup>2</sup> Castings, . . .	1	-	448 50 <sup>1</sup>	Gibby Foundry Company.
7	78 Sluice-gate in the Cambridge Marginal Conduit.	1	-	1,673 00 <sup>1</sup>	The Lockwood Manufacturing Company.
8	79 Structural steel for the Cambridge Marginal Conduit and the sluices.	4	515 00	467 00 <sup>1</sup>	H. P. Converse & Company.
9	80 Gate stems and guide brackets for the Lock and the Cambridge Marginal Conduit.	1	-	227 00 <sup>1</sup>	The Lockwood Manufacturing Company.
10	82 <sup>2</sup> Temporary house for lock-gate and draw-bridge controlling apparatus.	3	675 00	578 00 <sup>1</sup>	David S. McCabe, Boston, Mass.
11	83 <sup>2</sup> Electrical wire cables, .	2	718 76	501 43 <sup>1</sup>	F. M. Ferrin, Boston, Mass.
12	85 Plug drain valves for the Fens gate-house.	1	-	238 00 <sup>1</sup>	Coldwell-Wilcox Company.
13	86 Twisted steel rods for reinforcing concrete.	4	1,053 41	1,051 38 <sup>1</sup>	Aberthaw Construction Company.
14	Special Order. <sup>5</sup> 28-foot gasoline launch,	4	570 00 <sup>1</sup>	500 00	Baker Yacht Basin, Inc., Quincy Point, Mass.
15	Special Order. <sup>5</sup> Engine and fittings for 28-foot gasoline launch.	- <sup>5</sup>	- <sup>5</sup>	716 00 <sup>1</sup>	Buffalo Gasoline Motor Company, Boston, Mass.
	Totals, . . . .				

<sup>1</sup> Contract based upon this bid.<sup>2</sup> Contract completed.<sup>3</sup> Bids were upon designs submitted by bidders.

# APPENDIX B.

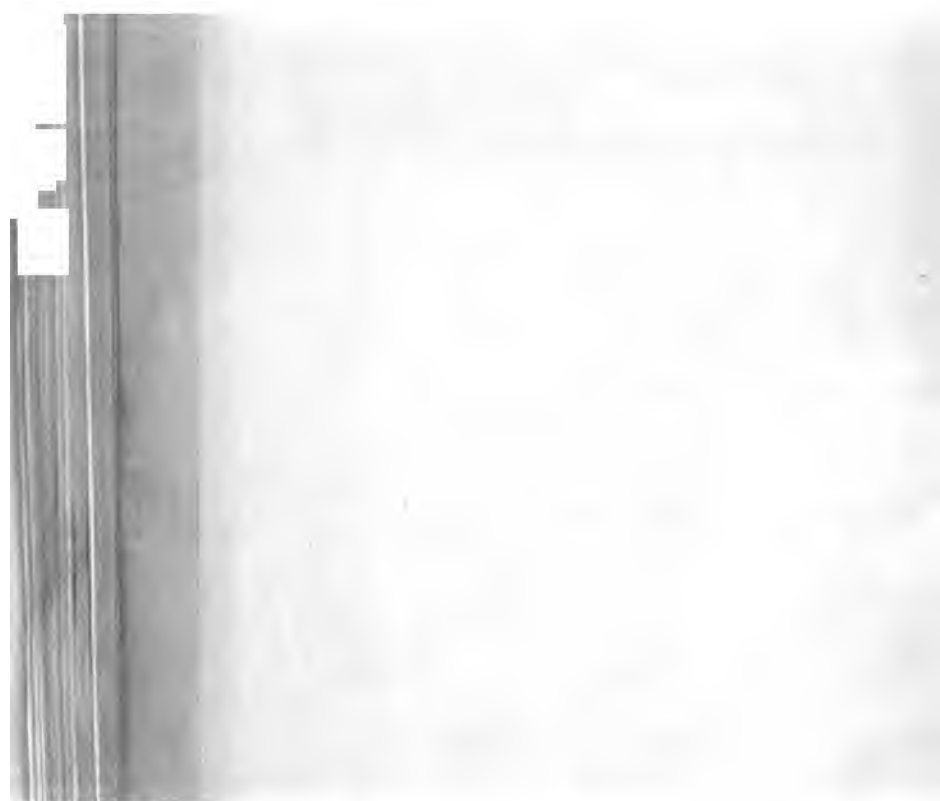
83

THE YEAR ENDING NOV. 30, 1907 — *Concluded.*

7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Nov. 30, 1907.	
Sept. 12, '07,	Nov. 19, '07,	-	For the whole work, \$1,350.	\$1,350 00	-	1
June 25, '07,	Aug. 15, '07,	Oct. 4, '07,	For square twisted steel rods, 1.9375 cents and 2.1125 cents per lb.	1,032 19	\$1,032 19	2
Aug. 9, '07,	Dec. 27, '07,	-	For the whole work, \$495.	495 00	-	3
Aug. 30, '07,	-	-	For the whole work, \$1,393.20.	1,393 20	-	4
Sept. 12, '07,	May 1, '08,	-	For the whole work, \$14,500.	14,500 00	789 50	5
Aug. 23, '07,	Nov. 26, '07,	Oct. 15, '07,	For iron castings, \$0.11 and \$0.035 per lb.	439 65	439 65	6
Sept. 19, '07,	-	-	For the whole work, \$1,673.	1,673 00	-	7
Sept. 9, '07,	Dec. 8, '07,	-	For the whole work, \$467.	467 00	-	8
Sept. 30, '07,	Nov. 29, '07,	-	For the whole work, \$227.	227 00	-	9
Sept. 5, '07,	Sept. 16, '07,	Sept. 21, '07,	For the whole work, \$578.	578 00	578 00	10
Sept. 10, '07,	Sept. 17, '07,	Sept. 21, '07,	For rubber covered and leaded cables, \$0.465, \$0.36 and \$0.20 per ft., weather proof cable, \$0.21 per lb.	591 43	591 43	11
Nov. 4, '07,	Feb. 2, '08,	-	For the whole work, \$238.	238 00	-	12
Nov. 29, '07,	Mar. 1, '08,	-	For square twisted steel rods, \$1.92, \$2.02, and \$2.12 per hundred lbs.	1,051 38	-	13
Feb. 25, '07,	Apr. 15, '07,	May 11, '07,	For the whole work, \$570.	617 44	617 44	14
Feb. 28, '07,	Mar. 20, '07,	May 14, '07,	For the whole work, \$716.	716 00	716 00	15
. . .	. . .	. . .	. . . . .	\$1,983,896 51	\$1,012,242 13	

<sup>1</sup> Bids were upon different types of compressors.

<sup>2</sup> Competitive bids were not received on this contract.



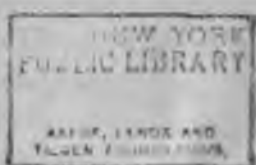


5-44<sup>1</sup>



12

5-642



5-8Y-3



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